

EXHIBIT 1

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK



Sep 19 2011
7:39PM

In re: Methyl Tertiary Butyl Ether
("MTBE")
Products Liability Litigation

Master File No. 1:00-1898
MDL 1358 (SAS)
M21-88

This Document Relates To:

City of Fresno v. Chevron U.S.A. Inc., et al.
No. 04 Civ. 04973 (SAS)

EXPERT REPORT OF JAMES E. BRUYA, Ph.D.

September 19, 2011

A handwritten signature in black ink that reads "James E. Bruya". The signature is written in a cursive, flowing style.

James E. Bruya, Ph.D.
Seattle, Washington

EXHIBIT 1

DISCLOSURE OF WRITTEN REPORT BY EXPERT
JAMES E. BRUYA [FRCP 26(2)(B)]

This written report is submitted in compliance with the disclosure requirements set forth in FRCP 26(2)(B), subject to the right to supplement the report in accordance with FRCP 26(e)(2).

Section 1 - INTRODUCTION

Experience and Qualifications

My name is James E. Bruya. I am a principal with Friedman & Bruya, Inc., an environmental testing and consulting firm located in Seattle, Washington. I graduated from Washington State University as a member of the Phi Beta Kappa and Phi Lambda Upsilon honorary societies. I then attended Stanford University and obtained my Ph.D. in 1977. I worked for the National Oceanic and Atmospheric Administration (NOAA) National Analytical Facility under contract to the EPA. This work involved the development of analytical techniques to test marine waters, sediments and biota for pollutants, particularly those that result from the release of petroleum into the environment. I then worked for the US Air Force Energy Management Laboratory testing and troubleshooting problems associated with the storage and handling of fuels. I helped found Friedman & Bruya, Inc. in 1987.

With Friedman & Bruya I have directed the development of analytical methods for the characterization and quantitation of hazardous materials. This included the design of on-site testing programs used at Superfund Sites along the West Coast in the late 1980's. This was at a time when regulatory agencies were characterizing on-site testing programs as unworkable. The programs were successful and are now common practice in the industry. I helped develop and implement the analytical testing methods that are currently used by laboratories around the country for the characterization of petroleum products. I, as well as Friedman & Bruya, Inc., are recognized as experts in explaining chemical test results.

The bulk of work performed by Friedman & Bruya, Inc. involves testing and reporting on samples for regulatory purposes. Our clients include both governmental agencies, corporations, limited liability companies, engineering and consulting firms, as well as private individuals. In addition to our regulatory work, we provide some consulting services as well. These services are varied and included the design and implementation of site specific testing and quality assurance programs and the review of existing analytical data. I have provided expert witness services on issues dealing with petroleum products, chlorinated solvents and manufactured gas plant wastes among others. Cases in which I have provided expert witness services include arbitrations, municipal, as well as federal proceedings. Past clients include governmental agencies including the Department of Justice, large and small corporations, as well as private individuals.

My resume, bibliography of publications and presentations, and summary of testimony are provided as Attachment 1.

Compensation

Friedman & Bruya, Inc. is being compensated at a rate of \$225 per hour for my consulting services. In addition, my firm, Friedman & Bruya, Inc. was compensated at a rate of \$240 per sample for the analysis of the samples sent by the City of Fresno. The work performed includes sample analysis, data evaluation, report preparation, and oral explanation of my findings or opinions.

Summary of My Opinions

From 2008 through 2011 samples from a number of water wells have been submitted by the City of Fresno and analyzed for t-butyl alcohol (TBA) and MTBE (methyl t-butyl ether). MTBE was present in multiple samples. A summary of these findings (see Attachment 2) can be found in Table 1, which is provided as Attachment 3.

The samples submitted for analysis by City of Fresno included samples of water from various sampling locations, as well as quality assurance samples such as trip blanks and field blanks. These latter quality assurance samples were collected to assess the potential for the introduction of contamination from sampling practices and shipping conditions. Review of the results indicate that there is no evidence for the introduction of MTBE or TBA into the samples collected due to sampling practices and shipping conditions.

Method Blank samples were also prepared to assess the potential for the introduction of laboratory contamination. None of these samples showed contamination by MTBE or TBA. These findings indicate that the laboratory practices were not the source of MTBE and TBA contamination found in the City of Fresno samples. In my opinion, the MTBE found in the site samples is due to MTBE present in the water collected for analysis. Evaluation of the quality assurance results indicated that the MTBE results obtained are reliable, precise and accurate.

The conclusions and opinions included in this report are based on my experience, educational training and literature that I have reviewed throughout my career, as well as the documents generated by Friedman & Bruya and reviewed which are specific to this case. I reserve the right to supplement or update this report or the opinions contained herein should further information become available which would have a bearing on my opinions.

Background

I have been retained by Miller, Axline & Sawyer on the matter of the reported presence of gasoline oxygenates in water samples collected from the drinking water aquifer used by the City of Fresno. I have received and analyzed water samples collected and sent by the

City of Fresno. I have directed the analysis and performed the review and interpretation of the data utilized in formulating opinions in this case. These samples were analyzed for gasoline oxygenates MTBE and TBA using EPA testing procedures 8260B, 8260C, and 524.2. My opinions are based on the testing that was conducted, as well as on my educational training, industry experience and other literature that I have reviewed in the normal course of my business.

SECTION 2 - THE SCIENCE BEHIND THE TESTING EQUIPMENT

EPA methods 8260B, 8260C, and 524.2 dictate the use of a gas chromatograph coupled to a mass spectrometer (GC/MS) as the testing equipment for samples. This testing equipment is used throughout the world to detect and measure a wide variety of chemical compounds. It is used in hospitals, research facilities, chemical production facilities, crime labs and environmental testing laboratories to look for chemicals that can adversely impact our health, that are illegal or for research purposes.

Through the use of calibration procedures, the time that it takes a molecule (analyte) to pass through the gas chromatograph (GC) is established. The GC is typically configured so that a given analyte will pass through the GC within a narrow time window that is specific for each analyte. When analyzing a sample with unknown levels of analytes, the detection of a material within one analyte's characteristic time window constitutes a tentative identification of that analyte.

The mass spectrometer (MS) is used to confirm the tentative identification provided by the GC. Here, the material that exits the GC is ionized, accelerated and passed into a MS. The MS is operated to detect and measure ions based on their mass. Molecules like MTBE will ionize and produce ions that are characteristic of MTBE. Different molecules like TBA will also ionize but will produce a different set of ions that are characteristic of TBA. By monitoring the ions that are produced by the MS, the MS can confirm the tentative analyte identification provided by the GC. If the MS confirms the GC findings, a positive finding of the analyte is reported.

The MS also provides information used to determine the amount of an analyte that is present. The MS produces an electrical signal that is proportional to the number of ions that are detected. The more ions, the greater the MS electronic signal. The relationship between the MS signal and the ions detected is established by the initial calibration and confirmed by the analysis of continuing calibration verification (CCV) samples. It is further monitored within each sample analyzed using internal standards and surrogates.

In summary, the GC/MS is a highly reliable and precise analytical testing device. Incorporation of quality assurance and quality control measures as specified in EPA Method 8260B, 8260C and 524.2 make it unsurpassed in its ability to detect and measure gasoline constituents in water.

DOCUMENTATION OF THE TESTING PROCEDURE

Practices Followed Before Samples Are Analyzed

The analysis of water samples for gasoline constituents is a very involved process. There are detailed procedures and practices that are followed to make sure that the laboratory can accurately analyze water samples.

Before developing a methodology to analyze for MTBE at concentrations below 1 part per billion ("ppb"), Friedman & Bruya worked with a number of regulatory agencies to ensure that the work we perform would be done in a manner that was in conformance with standard EPA practices and acceptable to various regulatory agencies. Initially, we prepared a written standard operating procedure (SOP) that describes the practices followed by my laboratory. Once we were convinced that we could reliably analyze samples, a performance evaluation (PE) sample (a water sample containing amounts of gasoline constituents in water) was purchased. The PE sample contains gasoline constituents at levels that are unknown to the laboratory. We analyzed the sample and submitted our findings to the PE provider who then evaluated the results to determine if we were able to obtain "acceptable" results. When successful, the written SOP and documentation of acceptable PE results were submitted to a selected accrediting agency. Based on their review, the desired accreditations were obtained. To maintain accreditations, we have regularly documented our ability to obtain acceptable results by performing PE studies every 6 months.

The practices that we followed when analyzing City of Fresno samples were based on EPA Methods 8260B (updated to EPA Method 8260C) and 524.2. These are methods that outline the practices that a laboratory follows in the course of analyzing water and reporting the findings. Copies of these three methods have previously been provided in connection with document requests and my opinions in other matters. In the course of implementing the practices described by these EPA methods, a laboratory must refine the sometimes general EPA practices into those that will be used by the laboratory. Our laboratory reviewed EPA Methods 8260B, 8260C, and 524.2 and documented our refinements in our SOPs.

As testing equipment improved and circumstances changed over time, EPA methods changed. These changes were instituted to improve the practices that are followed. These changes required changes in our SOPs, the result of which are multiple SOPs over the course of several years. Copies of the SOPs used in the course of analyzing samples submitted by the City of Fresno have been previously provided in connection with document requests and my opinions in other matters.

As discussed above, the analysis of PE samples is an integral part of our testing program to ensure the production of reliable data. Copies of our PE results from the relevant time periods have been previously provided in connection with document requests and my opinions in other matters.

Because we conduct testing from many parts of the country, our requests for accreditation were made to a number of agencies including the Washington State Department of Ecology, California Department of Health Services, California Department of Public Health, and the New Jersey Department of Environmental Protection among others. In 2004 we received a national accreditation (National Environmental Laboratory Accreditation Program or NELAP) administered by the Oregon State Public Health Laboratory.

The above government agencies reviewed our procedures, PE results and employee qualifications. Some conducted on-site reviews of our facility, equipment, personnel and practices. Findings from the reviews conducted by the state of Oregon have been previously provided in connection with document requests and my opinions in other matters. Because the Oregon accreditation is used by California as part of California's accreditation process, both our California and Oregon accreditations were previously provided in connection with document requests and my opinions in other matters. These accreditations include the accreditation of use of EPA Methods 8260B, 8260C and 524.2, as well as other methods.

Before analysis of client samples, additional testing was needed. To document our ability to detect and measure gasoline constituents in water samples, MDL (method detection limit) studies were conducted. Here, a series of water samples spiked with known amounts of gasoline constituents were analyzed and the findings evaluated. The practices proscribed by the EPA for MDL studies were followed and the results with supporting documentation were previously provided in connection with document requests and my opinions in other matters. As with the PE studies, MDL studies are conducted at regular intervals to document the continued performance of the testing equipment and practices. The MDL is defined by the EPA as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero."

Once our laboratory had prepared our SOPs, analyzed PE samples, had our practices evaluated by regulatory agencies and conducted MDL studies, we were ready to accept client samples for analysis by the various EPA methods.

Additional Practices Followed When Analyzing Client Samples

When a client sample is received for analysis, a detailed and very extensive quality assurance and quality control program is begun. Upon receipt at our laboratory, client samples are subjected to a tracking system that allows for the identification of the samples and associated analytical testing data within the laboratory. Because several clients may use the same sample identifier such as Well-1, we have implemented a tracking system that allows us to track individual sample containers within the laboratory. This is important to ensure that the data reported is accurate and valid. The discussion below tracks the handling of the samples at Friedman & Bruya and includes a description of the

sample check-in, storage, instrument calibration, calibration checks, analysis of project specific quality assurance samples, sample analysis and such. It is important to know that all samples analyzed undergo essentially the same general practices.

At the time that the client samples are received, they are assigned a project identifier code and a sequence number. The first set of samples received in a package is assigned our project identifier number, and then subsequent individual samples are assigned sequential numbers. These sequential numbers are written on the Chain-Of-Custody at the time that the samples are received. This cross reference allows us to track the analysis of each sample container within the laboratory while allowing us to provide the results using the names or sampling identifiers that are used by our clients.

Once a sample is received and the laboratory number assigned, it is stored in a refrigerator until it is time for analysis. The temperature of the refrigerator is set to be near zero and the refrigerator temperature is regularly monitored. Because of the nature of testing samples for low levels of MTBE, separate refrigerators were purchased and placed in an isolated part of my laboratory to minimize the potential for the introduction of MTBE contamination into a sample while it was stored at my laboratory.

In preparation for analyzing samples, an initial calibration is performed. Copies of relevant initial calibrations were previously provided in connection with document requests and my opinions in other matters. A series of standards containing known concentrations of the chemicals of interest are then prepared and analyzed. The results from these analyses document the relationship between the concentration of a gasoline constituent like MTBE and its response from the testing equipment. A successful initial calibration allows one to take the response obtained from the analysis of a sample and calculate the concentration of a gasoline constituent. EPA Methods 8260B, 8260C, and 524.2, as well as our own standard operating procedures, identify specific requirements that the initial calibration must meet before client sample analysis begins.

Once the instrument is calibrated, we are ready to analyze the samples. The client samples are removed from the refrigerator and placed on the laboratory workbench. Quality assurance samples are then prepared along side the client samples. A method blank sample is prepared using pre-cleaned water to determine if anything in the sample processing area could contaminate the samples. One or more samples are selected to be analyzed twice to determine any variability between the results. A laboratory control sample (LCS) or fortified blank sample was also prepared. This type of sample is prepared using pre-clean water and then a known amount of contamination is added. The results from this analysis are then compared to the actual amount of contamination that was added. Worksheets documenting the preparation of the samples from the City of Fresno were previously provided in connection with my deposition.

Once the client samples and quality assurance samples are prepared, they are loaded into the testing equipment along with additional quality assurance and quality control samples. (It is important to note that the City of Fresno samples have not yet been opened

from the time that the samples were collected in the field.) A sequence or set of computer instructions is prepared that direct the testing equipment to automatically analyze the samples.

Samples are separated into one or more batch of samples. A batch of samples consists of those samples that are analyzed within 12 hours. At the beginning of each batch of samples, a tune samples, identified as 50 ng BFB, is analyzed. The tune, using BFB (bromofluorobenzene), is performed to ensure that the testing equipment is configured in an appropriate manner to allow direct comparison of MS results from day to day, from instrument to instrument and from laboratory to laboratory. A satisfactory tune is required to proceed.

Further tests are run to ensure the reliability of the calibration. These continuing calibration verification (CCV) samples consist of a standard containing the gasoline constituents at known concentrations. The results are compared to the amounts expected to be present. EPA method criteria, provided in our SOP, are used to determine if the calibration of the testing equipment was satisfactory.

The quality assurance samples, method blank, duplicate and laboratory control sample (LCS) or fortified blank sample, are analyzed along with the samples. The results from the method blank are used to monitor for the potential for the introduction of contamination by the laboratory. The duplicate result is compared with the initial client sample result and the result provides a measure of the precision of the analysis. The results from the laboratory control sample or fortified blank sample are used to determine the accuracy of the analysis.

The results from the analysis of the blank, sample duplicate and LCS are documented and presented as quality assurance data. The quality assurance and quality control testing is associated with the analysis of samples that are separate from the client samples. There are additional quality assurance and quality control practices that are carried out on each and every sample analyzed. Internal standards are added to each sample analyzed. The internal standards are chemicals added to the samples which are not expected to be naturally found in the samples and which are expected to behave in a manner similar to the gasoline constituents MTBE and TBA. The amount of the internal standards detected in each sample analyzed are monitored and must meet EPA method criteria.

Surrogates are also added to each sample analyzed. Surrogates (system monitoring compounds) are used in a manner similar to the internal standards, but the percent recovery (amount detected and measured divided by the actual amount added to the sample multiplied by 100) is reported along with the sample results. Criteria for the amount of recovery of the surrogates are also specified by the testing method and the criteria are provided with the surrogate recovery results. These sheets show the response and concentration of the internal standards, surrogates and target gasoline constituents such as MTBE and TBA. The concentration, if found, of the gasoline constituents is provided. If nothing was found, the concentration is listed as "N.D." These data are then

electronically processed and incorporated into the report that we issue. All the data are reviewed by at least 2 individuals before the final report is issued.

In summary, at the time that the City of Fresno samples were analyzed, my laboratory was being evaluated on a regular basis by a variety of regulatory agencies to ensure that we were following the EPA methods correctly. A variety of quality assurance samples, as required by EPA methods, were analyzed with each group of City of Fresno samples. These samples are used to check the calibration of the instrument. Some quality assurance samples were used to look for the possible introduction of contamination into the samples caused by the laboratory. Other samples were analyzed to provide a measure of the accuracy and precision of the analysis. Additional quality assurance practices were followed that monitored each sample to ensure that it was processed correctly. Only when all of these multiple layers of laboratory review and quality assurance practices were satisfactory did we report the findings from our analysis of the City of Fresno samples.

Exhibits

The exhibits that will be used to summarize or support the opinions expressed in this report are the exhibits or attachments which appear in, or are transmitted with, this report. The exhibits may later be enlarged, set into a PowerPoint or similar electronic presentation format, or otherwise presented in a manner appropriate to the proceeding where they are used.

Attachment 1

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

JAMES E. BRUYA

Education:

National Institutes of Health Postdoctoral Fellow,
University of Rochester, 1978-1980
Stanford University, Ph.D., 1977
Washington State University, B.S. in Chemistry, 1973
Phi Beta Kappa, 1973
Phi Lambda Upsilon, 1972

Dr. Bruya is one of the founding partners of Friedman & Bruya, Inc. This firm specializes in providing the private sector with expert chemical consulting and testing services. Prior to starting Friedman & Bruya, Dr. Bruya worked for the NOAA National Analytical Facility under contract to the EPA. This work involved the development of analytical techniques to measure marine waters, sediments and biota for pollutants, particularly those that result from the release of petroleum into the marine environment. He later worked for the US Air Force Energy Management Laboratory testing and troubleshooting problems associated with the storage and handling of fuels.

With Friedman & Bruya Dr. Bruya has been associated with the development of analytical methods for the characterization and quantitation of hazardous materials. This included the design of on-site testing programs at Superfund Sites along the West Coast in the late 1980's. This was at a time when regulatory agencies were characterizing such testing programs as unworkable. The programs were successful and are now common practice in the industry. He helped develop and implement the analytical testing methods that are currently used by laboratories around the country for the characterization of petroleum products. Dr. Bruya and Friedman & Bruya, Inc. are widely recognized as experts in the area of petroleum product identification, as well as experts in explaining the significance of chemical test results.

Dr. Bruya has provided expert witness services on issues including petroleum hydrocarbons, chlorinated solvents and manufactured gas plant wastes. This work can involve the design and implementation of site specific testing and quality assurance programs or the review of existing analytical data. Cases include municipal, as well as federal proceedings and clients have included governmental agencies, large corporations and private individuals.

Dr. Bruya currently teaches workshops and seminars throughout the United States on chemical topics ranging from sample collection to the design of chemical testing programs. He continues to assist clients in the design and implementation of sampling and analysis programs. This work is often targeted at those projects where accuracy, rather than regulatory acceptance, is the prime consideration.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya

Dr. Bruya is also one of the founding partners of dTEC Systems, LLC. This firm develops chemical sensors with help in part from various granting agencies within the US Government. With dTEC Systems, Dr. Bruya works as both an inventor and investigator

Publications/Presentations:

Bruya, J.E. and L. Eng, Analytical Techniques for Determining Petroleum Products in Soils and Groundwater, a workshop presented at the 3rd Annual West Coast Conference on Hydrocarbon Contaminated Soils and Groundwater; March 11, 1992, Sheraton Long Beach, Long Beach, CA.

Bruya, J.E., Analysis of Samples and Degradation in the Environment, a workshop presented at R&D '92; February 6, 1992, San Francisco, CA.

Bruya, J.E. and A.J. Friedman, Don't Make Waves, Soils, January-February 1992.

Potter, T.L. and J.E. Bruya, Analysis of Petroleum Contaminated Soil and Water, a workshop presented at the 6th Annual Conference Hydrocarbon Contaminated Soils: Analysis, Fate, Environmental and Public Health Effects, Remediation and Regulation; September 23, 1991, University of Massachusetts at Amherst.

Bruya, J.E. and A.J. Friedman, On-Site Analysis of Petroleum Hydrocarbons Using Thin Layer Chromatography, Hydrocarbon Contaminated Soils, Volume 1: Remediation Technologies, Environmental Fate, Risk Assessment, Analytical Methodologies, Regulatory Considerations, Lewis Publishers, 1991.

Bruya, J.E. and A.J. Friedman, Analysis of Water Samples for Total Petroleum Hydrocarbons, Waste Business West, Volume 2, Number 2, April 1991.

Bruya, J.E. and A.J. Friedman, Thin Layer Chromatography, Try a Little TLC, Soils, May-June, 1991.

Friedman, A.J. and J.E. Bruya, Fingerprinting Crude, Soils, January-February 1991.

Bruya, J.E. and A.J. Friedman, On-Site Analysis Using Thin Layer Chromatography, Environmental Waste Management, May 1990.

Bruya, J.E., D.A. Zemo and T.E. Graf, The Importance and Benefit of Fingerprint Characterization in Site Investigation and Remediation Focusing on Petroleum Hydrocarbons, 1993 Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration, The American Petroleum Institute and The Association of Ground Water Scientists and Engineers, Houston, TX, November 1993.

Bruya, J.E., D.A. Zemo, Use of Petroleum Product Identification in the Development of Remedial Strategies, National Ground Water Association Eighth National Outdoor Action Conference and Exposition, Minneapolis, MN, May 23, 1994.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Publications/Presentations:

Bruya, J.E., Use of "Chemical Fingerprinting" to Determine the Origin and Age of a Petroleum Release, University of Wisconsin extension course entitled "Proving the Technical Case: Soil and Groundwater Contamination Litigation with an Emphasis on Hydrocarbons, Santa Fe, NM, May 9-10, 1994.

Bruya, J.E., Interpretation of Laboratory Analysis of Chlorinated Solvents, University of Wisconsin extension course entitled "Proving the Technical Case: Soil and Groundwater Contamination Litigation with Emphasis on Chlorinated Solvent Contamination, San Jose, CA, November 9-10, 1994.

Bruya, J.E. and L. Eng, Petroleum Hydrocarbons: What are they?, How much is present?, Where do they go?, Workshop presented at HAZMACon 1992, Long Beach, CA and HAZMACon 1993 and 1995, San Jose, CA.

Bruya, J.E., Petroleum Hydrocarbons: What are they?, How much is present?, Where do they go?, Workshop presented at HAZMACon 1994, San Jose, CA.

Bruya, J.E., Albertson, B. and A.J. Friedman, On-site Analysis of Petroleum Hydrocarbons using Thin-Layer Chromatography, Waste Business Magazine, February/March 1995.

Bruya, J.E., D.A. Zemo, T.E. Graf, James W. Embree, and Kevin L. Graves, Recommended Analytical Suite for Soil and Groundwater Samples Affected by Petroleum Hydrocarbons, White Paper prepared for the consideration of the Lawrence Livermore National Laboratory Leaking Underground Fuel Tank Manual Revision, March 1995.

Bruya, J.E., D.A. Zemo and T. E. Graf, The Application of Petroleum Hydrocarbon Fingerprint Characterization in Site Investigation and Remediation, Ground Water Monitoring Report, Spring 1995.

Bruya, J.E., Overview of Hydrocarbon Fingerprinting Techniques and Sources of Analytical Error, University of Wisconsin extension course entitled "Environmental Litigation: Hydrocarbons, Chlorinated Solvents and Visual Display of Evidence, Kahuku, Oahu, HI, December 1-2, 1995.

Bruya, J.E., D.A. Zemo, Petroleum Hydrocarbons: Chemistry, Fingerprinting, and Emerging Analytical Methods, National Ground Water Association Tenth National Outdoor Action Conference and Exposition, Las Vegas, NV, May 13, 1996.

Bruya, J.E., Proving the Technical Case: Chlorinated Solvents and Hydrocarbons, University of Wisconsin extension course, Las Vegas, NV, September 24-26, 1996.

Bruya, J.E., D.A. Zemo, Petroleum Hydrocarbons: Chemistry, Fingerprinting and Emerging Analytical Protocol Methods, National Ground Water Association Eleventh National Outdoor Action Conference and Exposition, Las Vegas, NV, April 3, 1997.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Publications/Presentations:

Bruya, J.E., Scientific Analysis to Determine the Date of Release, Insurance Coverage of Environmental Contamination, Environmental Law Education Center, Portland, OR, December 11, 1997.

G.R Foote, D.A. Zemo, S.M. Gallardo, M.J. Grant, B.T. Benson, J.E. Bruya 1997. Interferences with TPH Analysis of Groundwater Samples. Principles and Practices for Diesel Contaminated Soils, Volume VI pp. 27-39. Amherst Scientific Publishers, Amherst, MA.

Bruya, J.E., How To Evaluate Analytical Data: A Problem-Solving Workshop For Litigators and Consultants; How To Identify Misinterpreted Hydrocarbon Results: Case Histories, University of Wisconsin National Environmental Forensic Conference: Chlorinated Solvents and Petroleum Hydrocarbons, Tucson, AZ, August 27-28, 1998.

Bruya, J.E., Hydrocarbon Fingerprinting: Techniques, Applications and Interpretation, Forensics In Environmental Science Technical Applications, Chicago, IL, September 9-10, 1998

Bruya, J.E., Hydrocarbon Data Validation - Forensic Investigations, IBC's 2nd Annual Executive Forum on Environmental Forensics; Integrating Advanced Scientific Techniques for Unraveling Site Liability, Washington, DC, June 24-25, 1999.

Bruya, J.E., Hydrocarbon Fingerprinting: Techniques, Application and Interpretation, Forensics In Environmental Science Technical Applications, Chicago, IL, November 8-10, 1999

Bruya, J.E., Source Identification and Age Dating Hydrocarbons. What is Available?, University of Wisconsin Course; Environmental Litigation: Advanced Forensics and Legal Strategies, San Francisco, CA, April 13-14, 2000.

Bruya, J.E., Hydrocarbon Fingerprinting: Techniques, Application and Interpretation, Forensics In Environmental Science and Technical Applications, EPA In-House Environmental Forensics Course sponsored by The University of Wisconsin-Madison, Lakewood, CO, June 19-21, 2000

Contributing author to: Sullivan, P.J., Franklin J. Agardy and Richard K. Traub, Practical Environmental Forensics, John Wiley & Sons, Inc., New York, NY, 2001, ISBN 0-471-35398-1.

Bruya, J.E., Source Identification and Age Dating Hydrocarbons. Case Studies, University of Wisconsin Course; Environmental Litigation: Advanced Forensics and Legal Strategies, San Francisco, CA, April 4-5, 2001.

Bruya, J.E., Chemistry and Chemical Testing, State Coalition for Remediation of Drycleaners, Nashville, TN, May 7-10, 2002.

Bruya, J.E., Presentation on forensic testing, Northwest Environmental Conference, Portland, OR, October 16, 2002.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Publications/Presentations:

Bruya, J.E., B.T. Benson and K. Johnson, Fuel/Hydrocarbon Fingerprinting, presented at the 15th Annual Goldschmidt Conference, University of Idaho, Moscow, ID, May 20-25, 2005.

Bruya, J.E., M. Costales, Discussion of the Error Associated with Polycyclic Aromatic Hydrocarbon (PAH) Analyses, *Environmental Forensics*, 6:175-185, 2005.

Bruya, J.E., E. Weber, Forensic Chemistry - Identifying Contaminant Sources, *Creating Environmental Solutions*, Northwest Environmental Summit, Tacoma, WA, October 18, 2007.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Charlene Morrow, M.S.
Yelena Aravkina, M.S.
Bradley T. Benson, B.S.
Kurt Johnson, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
TEL: (206) 285-8282
FAX: (206) 283-5044
e-mail: fbi@isomedia.com

JAMES E. BRUYA

Record of Testimony
(2004 - Present)

Sunoco Inc. ats Campbell Steel and Iron Works Limited
Matter No. 020524/084700
Arbitration Testimony October 26 and 27, 2004

Merrimack Mutual Fire Insurance Company v. Thames Insurance Co.
File No. 5202-03015
Deposition Taken September 28, 2004
Trial Testimony November 4, 2004

Exxon Mobil Corporation v. New West Petroleum, LP, et. al.
U.S. District Court, Eastern District of California
Case No. CIV-S-03-2222 WBS PAN
Deposition Taken April 6, 2005
Trial Testimony September 26, 2007

Fred Beck, et. al. v. Koppers Inc, et. al.
U.S. District Court, Northern District of Mississippi
Civil Action No. 3:03CV60-P-D
Deposition Taken April 21, 2005
Trial Testimony April 21, 2006

Carson Harbor Village, Ltd., v. Carson Harbor Village Mobile Home Park, et. al.
Superior Court of the State of California, County of Los Angeles
Case No.: BC 306759
Deposition Taken November 9, 2005
Deposition Taken November 22, 2005

Timothy Urbanic, et. al. v. Appalachian Timber Services, Inc.
Circuit Court of Braxton County, Sutton, West Virginia
Civil Action No. 03-C-58
Deposition Taken May 23, 2006
Deposition Taken October 9, 2006

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya

State of New York v. A.M.N. Corp, et. al.
State of New York Supreme Court, County of Albany
Index No. L-00362-00
Trial Testimony October 30, 2006

Evered Motors, Inc. v. Terra Vac, Inc.
Superior Court of Washington for King County
No. 05-2-27784-0 SEA
Deposition Taken September 18, 2007

Choi, et al. v. Giantceutical, et al.
San Francisco Superior Court No. CGC 05-445237
Client-Matter No. 095913586F
Deposition Taken February 20, 2008

Rhode Island DEM v. Getty Petroleum Marketing
Edwards Angell Palmer & Dodge LLP, Providence RI
RIDEM Administrative Hearing
Evidentiary Administrative Hearing Testimony May 6, 2008

Farwest Petroleum, Inc. v. Colony Insurance Company
Superior Court of Washington for King County
No. 06-2-34579-7SEA
Deposition Taken June 12, 2008

Tonneson, et al. vs. Sunoco, Inc, et al.
Basso, et al. v. Sunoco, Inc, et al.
US District Court, Southern District of New York
No. M21-88
Deposition Taken July 14, 2008
Deposition Taken November 25, 2008

Noretta Thomas, et al. v. A. Wilbert & Sons L.L.C., et al
Consolidated with
Troy Robichaux et al. v. State of Louisiana and Dow Chemical Company
18th Judicial District Court, Parish of Iberville
No. 55,127 and 56,803
Deposition Taken July 22, 2008
Deposition Taken January 20, 2009
Trial Testimony January 13 and 18, 2011

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya

Loren S. Riggins, Jr. vs. Anchor Hocking Corporation
Superior Court of New Jersey
No. CUM-L-000165003
Deposition Taken July 30, 2008

Washington Real Estate Investment Trust vs. Carroll Independent Fuel Co.
Circuit Court for Carroll County, Maryland
No. 06-C-07-049278
Deposition Taken January 8, 2009
Trial Testimony April 29, 2009

City of Merced v. Chevron U.S.A., Inc. et.al.
Merced County Superior Court
Case No. 148451
Deposition Taken July 28 and 29, 2009
Deposition Taken January 20, 2010
Deposition Taken June 23 and 24, 2011

Crescenta Valley Water District v. Mobil Corporation et.al.
US District Court, Southern District of New York
Case No. 07 civ. 9453 (SAS)
Deposition Taken November 9 and 10, 2010

John Pappas v. Don Throne et.al.
Yolo County Superior Court of California
Case No. P008-1613
Deposition Taken April 29, 2011

City of Merced Redevelopment Agency v. Exxon Mobile
United States District Court
Master File No. 1:00-1898 MDL 1358 (SAS) M21-88
Deposition Taken June 23 and 24, 2011

Orange County Water District v. Unocal Corp et al.
United States District Court
Master File No. 1:00-1898 MDL No (SAS) M21-88
Deposition Taken June 23 and 24, 2011

Puget Soundkeeper Alliance v. BNSF Railway Company
U.S. District Court, Western District of Washington
Case No. C09-1087-JCC
Deposition Taken July 21, 2011

Attachment 2

Sample Period	Sample Date/Lab ID#	Bates Number
October 2008	08/03/2008 Lab ID: 810042	F&B-FRESNO-000890-001147
	08/17/2008 Lab ID: 810196	F&B-FRESNO-001311-001698
	08/24/2008 Lab ID: 810273	F&B-FRESNO-001699-001860
	08/28/2008 Lab ID: 810300	F&B-FRESNO-001861-002014
November 2008	11/04/2008 Lab ID: 811021	F&B-FRESNO-002015-002103
February 2011	02/10/2011 Lab ID: 102099	F&B-FRESNO-000402-000515
	02/16/2011 Lab ID: 102112	F&B-FRESNO-000516-000889

Attachment 3

Table 1. Reported findings from the analysis of water samples submitted from the City of Fresno

Sample ID	Lab ID	Date Analyzed	Method	MTBE (ug/L)	TBA (ug/L)
Well 9	810042-32	10/03/2008	8260B	<0.02	<1
Well 18	810042-26	10/03/2008	8260B	<0.02	<1
Well 27	810042-30	10/03/2008	8260B	<0.02	<1
Well 28	810042-28	10/03/2008	8260B	0.41	<1
Well No. 54 – well water	810042-15	10/03/2008	8260B	0.08	<1
Well No. 75 – well water	810042-10	10/03/2008	8260B	0.03	<1
Well 82-2	810042-21	10/03/2008	8260B	<0.02	<1
Well No. 101 – well water	810042-13	10/03/2008	8260B	<0.02	<1
Well 141	810042-01	10/03/2008	8260B	0.02	<1
Well 154	810042-05	10/03/2008	8260B	<0.02	<1
Well 162	810042-23	10/03/2008	8260B	0.10	<1
Well 166	810042-19	10/03/2008	8260B	<0.02	<1
Well 205	810042-17	10/03/2008	8260B	0.16	<1
Well 271	810042-07	10/03/2008	8260B	<0.02	<1
Well 3	810196-41	10/17/2008	8260B	<0.02	<2.5
Well 4-A	810196-39	10/17/2008	8260B	<0.02	<2.5
Well No. 5 – well sample	810196-04	10/17/2008	8260B	<0.02	<2.5
Well 13	810196-37	10/17/2008	8260B	<0.02	<2.5
Well No. 16	810196-19	10/17/2008	8260B	0.05	<2.5
Well 17 Well Water	810196-35	10/17/2008	8260B	0.04	<2.5
Well 19A Well	810196-10	10/17/2008	8260B	0.10	<2.5
Well 19B Well	810196-12	10/17/2008	8260B	<0.02	<2.5
Well No. 20	810196-21	10/17/2008	8260B	0.15	<2.5
Well No. 49-A	810196-23	10/17/2008	8260B	<0.02	<2.5
Well No. 56 – well sample	810196-06	10/17/2008	8260B	<0.02	<2.5
Well No. 58 – well sample	810196-02	10/17/2008	8260B	<0.02	<2.5
Well 70 Well	810196-16	10/17/2008	8260B	<0.02	<2.5
Well 74 Well Water	810196-33	10/17/2008	8260B	<0.02	<2.5
Well 118 Well Water	810196-31	10/17/2008	8260B	<0.02	<2.5
Well No. 165-2 Well	810196-14	10/17/2008	8260B	<0.02	<2.5
Well 192 Well Water	810196-29	10/17/2008	8260B	<0.02	<2.5
Well No. 193 – well water	810196-08	10/17/2008	8260B	<0.02	<2.5
Well No. 203A	810196-25	10/17/2008	8260B	<0.02	<2.5
Well 297-2	810196-43	10/17/2008	8260B	<0.02	<2.5
Well No. 30 – well water	810273-02	10/24/2008	8260B	<0.02	<2.5
Well No. 60 – well water	810273-06	10/24/2008	8260B	0.02	<2.5
Well No. 219 – well water	810273-04	10/24/2008	8260B	1.20	<2.5
Well No. 320 – well water	810273-08	10/24/2008	8260B	<0.02	<2.5
Well No. 366	810273-10	10/24/2008	8260B	<0.02	<2.5
Well No. 367	810273-12	10/24/2008	8260B	<0.02	<2.5
Well No. 2-B	810300-05	10/28/2008	8260B	<0.02	<2.5
Well No. 22-A	810300-07	10/28/2008	8260B	<0.02	<2.5
Well No. 221	810300-03	10/28/2008	8260B	0.03	<2.5
Well No. 352	810300-01	10/28/2008	8260B	<0.02	<2.5
Well No. 36	811021-03	11/04/2008	8260C	0.03	<2.5
Well No. 105	811021-01	11/04/2008	8260C	<0.02	<2.5
Well 9A	102099-06	02/09/2011	524.2	<0.02	<3
Well 16	102099-15	02/09/2011	524.2	0.025	<3

Sample ID	Lab ID	Date Analyzed	Method	MTBE (ug/L)	TBA (ug/L)
Well 18A	102099-01	02/09/2011	524.2	<0.02	<3
Well 19A	102099-14	02/09/2011	524.2	0.052	<3
Well 20	102099-13	02/09/2011	524.2	0.072	<3
Well 27	102099-07	02/09/2011	524.2	<0.02	<3
Well 28A	102099-03	02/09/2011	524.2	0.037	<3
Well 36	102099-19	02/09/2011	524.2	<0.02	<3
Well 41	102099-16	02/09/2011	524.2	0.035	<3
Well 45	102099-08	02/09/2011	524.2	<0.02	<3
Well 54	102099-05	02/09/2011	524.2	0.024	<3
Well 60	102099-22	02/09/2011	524.2	<0.02	<3
Well 62A	102099-10	02/09/2011	524.2	<0.02	<3
Well 73	102099-09	02/09/2011	524.2	<0.02	<3
Well 75	102099-27	02/09/2011	524.2	0.025	<3
Well 82-2	102099-30	02/09/2011	524.2	<0.02	<3
Well 101	102099-32	02/09/2011	524.2	<0.02	<3
Well 136	102099-25	02/09/2011	524.2	<0.02	<3
Well 141	102099-26	02/09/2011	524.2	<0.02	<3
Well 154	102099-24	02/09/2011	524.2	<0.02	<3
Well 162	102099-17	02/09/2011	524.2	0.038	<3
Well 166	102099-31	02/09/2011	524.2	<0.02	<3
Well 205	102099-18	02/09/2011	524.2	0.20	<3
Well 219	102099-04	02/09/2011	524.2	0.10	<3
Well 221	102099-02	02/09/2011	524.2	<0.02	<3
Well 271	102099-23	02/09/2011	524.2	<0.02	<3
PS320	102112-01	02/10/2011	524.2	<0.02	<3
MW320-245	102112-04	02/10/2011	524.2	<0.02	<3
MW320-450	102112-03	02/10/2011	524.2	<0.02	<3
MW320-660	102112-02	02/10/2011	524.2	<0.02	<3

PROOF OF SERVICE VIA LEXISNEXIS FILE AND SERVE

I, the undersigned, declare that I am, and was at the time of service of the paper(s) herein referred to, over the age of 18 years and not a party to this action. My business address is 1050 Fulton Avenue, Suite 100, Sacramento, CA 95825-4225.

On the date below, I served the following document on all counsel in this action electronically through LexisNexis File & Serve:

EXPERT REPORT OF JAMES E. BRUYA, PH.D.

I declare under penalty of perjury under the laws of the United States of America and the State of California that the foregoing is true and correct.

Executed on September 19, 2011, at Sacramento, California.



MATTHEW POPISH

EXHIBIT 2



UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

In re: Methyl Tertiary Butyl Ether ("MTBE")
Products Liability Litigation

Master File No. 1:00-1898
MDL 1358 (SAS)
M21-88

This Document Relates To:

City of Fresno v. Chevron U.S.A. Inc., et al.

EXPERT REPORT OF RICHARD L. HABERMAN, PE

Fresno, California

A handwritten signature in black ink, appearing to read "R. Haberman", written over a horizontal line.

Signature

11-30-2011

Date

EXHIBIT 2

This written report is submitted in compliance with the disclosure requirements set forth in FRCP 26(2)(B), subject to the right to supplement the report in accordance with FRCP 26(e)(2).

I. Experience and Qualifications

I have worked in the drinking water supply industry for over 35 years. I obtained a B.S. in Civil Engineering in 1971 and M.S. in Environmental Engineering in 1972. Both degrees are from the University of Iowa. Upon graduation in 1972 I was employed as a staff field civil engineer in the San Diego office of the California Department of Public Health (Department) in the summer of 1972. I transferred to the Santa Rosa office the following year for approximately 2 years. I then transferred to the Fresno office where I was assigned the duties of District Engineer (1979 to 2001) and later Regional Engineer for the Department (2001 to 2009). A resume of my education, work experience, duties and assignments is included in the appendices of this report.

The duties of a District Engineer for the Department include reviewing and approving water supply system design, construction and operations. By law a water utility must have a permit from the Department to supply water to their customers. A public water supply system's facilities must be designed, constructed and operated in accordance with all State statutes and regulations. Any changes to the system's physical facilities and/or operational practices must first be approved by the Department. The District Engineer is responsible for approving the issuance of permits to new systems and permit amendments to existing systems that allow water systems to expand systems facilities and/or modify their existing system operation. The number of systems for which a District Engineer is responsible will vary from approximately 50 large utilities in the southern California Los Angeles office to over 250 large and small water supply systems in the District located in Bakersfield CA. Four to ten Department staff members will assist the District Engineer in the oversight duties. The District Engineer is responsible for training these staff and providing guidance on the duties to be performed, utilities to be inspected and reviewed and reports to be drafted.

The duties of a Regional Engineer include the oversight of several Districts and the staff who work in these Districts. Regional Engineers assist the Districts that they oversee with guidance on the more unique and difficult to solve water supply problems. District and Regional Engineers also assist the Department's technical Branch in the development of new regulations that govern newly discovered contaminants and approval of newly developed treatment technologies. The Regional Engineer will also assist local county environmental health department staff who have the same oversight responsibilities for smaller public water supply utilities (systems with less than 200 service connections) in their county.

The District and Regional Engineers also work with water supply utilities on the development and operation of recycled water projects for use in their service areas.

During my years with the Department as District Engineer and Regional Engineer in the Fresno office I also served as Chairperson of the Department's Water Treatment committee that was charged with reviewing and approving various water treatment technologies as they were developed and the operational practices that were to be used to operate these facilities.

During my years with the Department I worked on almost all types of water supply contamination problems faced by the utilities in the State of California including the steps taken by utilities to address surface water and groundwater contamination and specifically regarding contamination of these resources by methyl tertiary-butyl ether (MTBE).

II. Additional Witness Information

As an expert witness in this matter I am being compensated at the hourly rate of \$350 for all time involving depositions and trial testimony, \$175 for travel time and \$300 for time spent reviewing the issues and preparing my report. No portion of my compensation is contingent upon the outcome of this litigation.

I have worked as an expert witness in the lawsuits or litigations listed below:

Crescenta Valley Water District v. Exxon Mobil Corp. et al., Case No. 07
Civ. 9453 (SAS)

State of New Hampshire v. Hess Corporation et al., Docket No.: 03-C-0550

City of Oceanside v. The Dow Chemical Co., et al.: Case No CGC-05-439807

Victor Guerrero, et al. v. California Water Service- Case No. FC034481

I have participated in the development and review of documents during the past 10 years which were internal policy documents used by the California Department of Public Health to implement various programs and regulations that were administered under the California Safe Drinking Water Act. Most of these documents were developed and finalized by Committees of the Department of Public Health of which I was a member. I have not authored or co-authored any other publications.

III. Information Relied Upon for Report and Opinions

In preparing this report and arriving at the opinions listed in the next section of this report I relied on my 35+ years of work experience at the Department of Public Health Drinking Water section, and the documents and personal communications listed at the end of this report.

IV. Summary of Opinions

- The secondary maximum contaminant level (MCL) for MTBE is 5 micrograms per liter (ug/l). Secondary MCLS are established to protect drinking water from the unpleasant or offensive taste or odor. The Department recognized in their "Statement of Reasons," however, that studies confirmed that some customers would be able to detect the smell or taste of MTBE below 2 ug/l.
- The primary MCL for MTBE is 13 ug/l. The MTBE primary or health based MCL was established in 1999 based on carcinogenetic health effects of the chemical that had been established at that time. California's Water Quality Policy, however, is to minimize the use of sources with any amount of

contamination, and MCLs “should not be used to condone contamination” of drinking water up to those levels.

- When a contaminant exceeds an MCL in a water source well and appropriate treatment is not provided, a utility is required by regulation to take the source out of service if they can meet system demand without the contaminated source.
- When treatment of a regulated contaminant is undertaken removal of the contaminant to non-detectable levels is commonly provided to maintain consumer confidence with supply and to assure MCL violations do not occur.
- Certain groundwater supply wells within the City of Fresno have had detectable concentrations of MTBE contamination.
- Maximum use of ground water supplies is critical to insuring a reliable supply of drinking water, including during emergency situations or droughts.
- Methyl tertiary butyl ether (MTBE) contamination of a ground water basin can result in the need to curtail the use of drinking water wells located in the groundwater basin to prevent spreading the contamination. This can cause a municipality to seek potentially more expensive alternative sources of water.
- Identifying MTBE contamination in a ground water basin will result in increased monitoring cost for utilities that use the basin as a drinking water source.

- If the City needed to install treatment to remove MTBE from drinking water wells the treatment of choice would be granular activated carbon (GAC).
- Loss of consumer confidence can occur when a community water supplier has to report to its customers that contamination has been identified in supply sources.

V. Background – State Regulations and Policies

A. Drinking Water Standards: MTBE Secondary MCL.

The secondary MCL (5 ug/l) for MTBE is set to control offending taste and odors associated with MTBE in the water. The Department set the secondary MCL at a level that was designed to assure as few customers as possible would detect the odor of the contaminant.

The Department's Statement of Reasons recognized that studies confirmed that some customers would be able to detect the smell or taste of MTBE below 2 ug/l and that setting a secondary MCL of 1 ug/l would protect a large portion of the public from the offending odor of this contaminant. The level of 5 ug/l was instead chosen as the secondary MCL because at that time the reliable detection level by laboratories was determined to be 3 ug/l and the Department felt that a lower level MCL may lead to false positive findings and then unnecessary follow up action by affected water utilities. Today, however, laboratories are reliably detecting and reporting levels of MTBE at 0.5 ug/l throughout the state. The Regional Water Quality Control Boards have been using the 0.5 ug/l as the "practical quantitation limit" for MTBE monitoring of ground water cleanup projects.

The California State Legislature implemented requirements that “secondary water quality standard” (standards set to regulate the aesthetic water quality) be enforced on water utilities in the same manner as primary or health based water quality standards. By complying with secondary water quality standards water supply utilities can be assured that the customers they serve will have confidence in their water supply and will not have to be concerned about foul smelling and tasting water or water that has a strange appearance.

B. Drinking Water Standards: State Policy and MCLs

It is the policy of the State to reduce to the lowest level feasible all concentrations of toxic chemicals that when present in drinking water may cause cancer, birth defects, and other chronic diseases.

The California Department of Public Health Policy Memo 97-005 states that

- “Where feasible choices are available, the sources presenting the least risk to the public health should be utilized”.
- “Water utilities should be encouraged to minimize the concentration of man-made toxic substances in drinking water supplies, maximum contaminant levels (MCL’s) not withstanding”.
- “Where reasonable alternatives are available, high quality drinking water should not be allowed to be degraded by the planned addition of contaminants. In other words, the MCL should not be used to condone contamination up to those levels where the addition of those contaminants can be reasonably avoided”
- “The use of contaminated water as a drinking water source always poses a greater health risk and hazard to the public than the use of uncontaminated sources because of the chance that necessary treatment may fail.”

The Department’s Policy Memo is consistent with the California Safe Drinking Water Act and related statutes which state that;

- Every citizen of California has the right to pure and safe drinking water.
- Feasibility and affordable technologies are available and should be used to remove toxic contaminants from public water supplies.
- It is the policy of the State to reduce to the lowest level feasible all concentrations of toxic chemicals that when present in drinking water may cause cancer, birth defects, and other chronic diseases.
- It is the intent of the Legislature to improve laws governing drinking water quality, to improve upon the minimum requirements of the federal Safe Drinking Water Act Amendments of 1996, to establish primary drinking water standards that are at least as stringent as those established under the federal Safe Drinking Water Act, and to establish a program under this chapter that is more protective of public health than the minimum federal requirements.

Overall, California and the Department take the position that drinking water should be of the highest quality feasible, and degradation should be avoided where possible.

VI. MTBE Treatment Options

Policy Memo 97-005 recognizes that use of contaminated sources “poses a greater health risk and hazard to the public . . . because of the chance that necessary treatment may fail.” Compliance with this section requires that when selecting among needed treatment processes that the treatment process least likely to fail be given a higher preference.

Granular activate carbon (GAC) treatment would be the preferred treatment for MTBE removal because it is commonly used throughout the State to control and clean up MTBE contamination and allows for best operational flexibility of

sources and reduces the need to locate potentially expensive alternative water supplies.

Using properly designed GAC treatment will assure better and more reliable treatment of the two as the carbon bed will completely remove all MTBE no matter what the influent levels. The GAC treatment vessels would be operated in series to allow for monitoring of the MTBE breakthrough in the first vessel and carbon change-out of this vessel while the second vessel is in operation and removing MTBE. Completely reducing the MTBE levels to the non-detectable levels is the public health recommended approach as it has been established that a portion of the population can detect the odors associated with MTBE at levels of 2 ug/l. This is consistent with California's Safe Drinking Water Act and related statutes which state that "[f]easible and affordable technologies . . . shall be used to remove toxic contaminants from public water supplies."

When the blending approach is used, a utility must also be sure that the influent levels of MTBE are known so that the correct blended flow can be calculated. This is not possible as no real time online MTBE analyzers exist and the concentrations in the well have shown significant variations over time.

Blending, as a MTBE treatment mitigation approach, will result in the loss of the ability to independently operate wells should their source of additional blended water be unavailable. The cost of the water used for blending must be compared to the contaminant removal cost. Any mitigation cost including the cost of importing water will be passed along to customers. *didn't they blend in Fresno?*

VI. Operational Issues and Responses to Contamination

Water demands in California now outpace supplies and drinking water utilities have for years recognized the need to make full use of their ground water basins. Detection of contamination in a drinking water well or anywhere in the utilities groundwater basin at any level can have significant impacts on the operation of a public drinking water system. The California Department of Toxics Substances Control has worked with the municipalities and water supply utilities serving the City's of Chico, Lodi, Fresno and Visalia to assure the operations of their water

supply wells do not worsen the identified groundwater contamination plumes identified in their groundwater basins.

When contamination is detected in a ground water basin used for drinking water supplies, utilities must be careful in the operation of their drinking water supply wells to assure that they do not expand an identified contaminate plume in a manner that will result in increased cost of needed clean-up and mitigation measures.

Even though an MTBE plume is not presently affecting drinking water supply wells, under certain circumstances, a utility may find it more cost effective to take mitigation measures to address the plume before it eventually spreads to water supply wells resulting in more expensive treatment costs to comply with MCLs and maintain consumer confidence. Cleaning up a concentrated contaminant plume in shallower groundwater aquifers is less expensive than allowing a plume to spread out and treating smaller concentrations over a wider area.

When treatment at an active well supply is provided the treatment goal would be set to assure that consumer confidence in their drinking water supply is not adversely affected and at a level that will assure failure of the treatment process does not result in an MCL violation. Utilities treating with GAC will typically set their operational treatment goals at non-detectable levels. MTBE treatment at the source can result in greater treatment cost than treatment at the identified contaminant site. In the case of the City of Fresno, the City has historically operated their DBCP GAC treatment to provide non-detectable levels in the effluent. Under the direction of CDPH, the City has operated DBCP GAC treatment plants for 2 years after the level of contamination in the supply well dropped to levels significantly below the MCL before discontinuing treatment.

In the past some utilities have attempted to move away from an identified contaminant plume and drill new replacement wells, a practice referred to as "Dodge and Drill". However, many times the new replacement wells had other contamination problems (arsenic contamination, radiological constituent contamination, etc) or later also became contaminated with the plume they were attempting to avoid. As a result this practice is no longer followed as it only increased the ultimate cleanup cost.

If a water well is in imminent danger of contamination from a plume, a utility may have to resort to the use of more expensive alternate supplies during times of extremely heavy demand periods, drought or other emergencies to avoid pulling the contamination into the well. These alternative supplies could include surface water sources requiring more expensive treatment, wells located sufficiently away from the contaminate plume resulting in more expensive pumping cost, wells that pump from deeper aquifers adding to pumping cost, or replacement wells that may have other contamination issues that need to be addressed prior to use as a drinking water supply.

The use of these more expensive supplies can be less expensive than continued operation of the wells near the identified plume resulting in movement of the plume in a manner that increases cost of needed mitigation measures.

A water supply utility's monitoring cost may increase when contaminant plumes are suspected to be present and moving through groundwater basins as the need to closely monitor the movement of contaminates plumes calls for a more frequent and location intensive monitoring requirements.

The finding of any regulated chemical in a utilities water supply also triggers the need to provide this information in the utilities required annual "Consumer Confidence Report" along with additional information regarding the level of the contaminant supply and information on the health effects of the indentified contaminant. This information can result in a loss of consumer confidence in the safety of the utilities supply, increased use of bottled water by utility customers, increased calls from consumers to utility offices seeking additional information, and overall concern and anxiety related to the utilities ability to handle the indentified contamination properly.

REFERENCES

1. Stockings, A. J.; Suffet, I. H.; McGuire M. J.; & Kavanaugh M. C.; *Implication of an MTBE odor study for setting drinking water standard* Jour. AWWA, March 2001

2. The Final Statement of Reasons, Secondary Maximum Contaminant Level for Methyl tert-Butyl Ether and Revisions to the Unregulated Chemical Monitoring List Title 22, California Code of Regulations which is available on line at the California Department of Public Health web site.
3. Additional documents posted on the DPH web site including memorandum dated November 1997 "Policy Memo 97005 Policy Guidance for Direct Domestic Use of Extremely Impaired Sources, MTBE: Regulations and Drinking Water Monitoring Results (last updated: October 29, 2009) and Public Health Goal for Methyl Tertiary Butyl Ether (MTBE) In Drinking Water.
4. The California Regional Water Quality Control Board Central Valley Region Order No. R5-2008-0149: Waste Discharge Requirements General Order For In Situ Groundwater Remediation At Sites With Volatile Organic ...and/or Petroleum Hydrocarbons.
5. Personal communications with Thomas Kovac, Supervising Hazardous Substance Engineer 1, California Department of Toxics Substances Control, Clovis office.
6. Fresno water quality data.

VI. Appendices

a. Resume

b. Fresno Water Quality Data

c. Department of Public Health Policies

- i. **Final Statement of Reasons; Secondary Maximum Contaminant Level for Methyl tert-Butyl Ether and Revisions to the Unregulated Chemical Monitoring List Title 22, California Code of Regulations**

- ii. Memorandum dated November 5, 1997; Policy Memo 97-005 Policy Guidance for Direct Domestic Use of Extremely Impaired Sources**
- d. California Central Valley Water Quality Control Board, Central Valley Region; Order No. R5-2008-0149; Waste Discharge Requirements General Order for In-situ Groundwater Remediation at Sites with Volatile Organic Compounds...and/or Petroleum Hydrocarbons.**

APPENDIX

A

Richard L. Haberman
1625 East Desert Island Drive
Fresno, CA 93720
(559) 434-3851 (home)
(559) 447-3131 (work)

Education, work experience and professional experience.
Supervising Engineer, Drinking Water Program, Department of Public Health, State of California

Education:

- B.S./Civil Engineering, University of Iowa, January 22, 1971
- M.S./Environmental Engineering, University of Iowa, January 21, 1972

Work Experience

- Water Treatment Plant Operator, University of Iowa, Iowa City, Iowa
- Field Sanitary Engineer, Michigan State Department of Public Health
- Field Sanitary Engineer, California Department of Health Services
- Senior Sanitary Engineer California Department of Health Services
- Supervising Sanitary Engineer California Department of Public Health (DPH)

Professional Qualifications:

- Professional Civil Engineer (certification # C23860)
- Member of American Water Works Association (AWWA)
- Member of the American Association for the Advancement of Science

Description of Work Experience

I have worked in the DPH San Diego, Santa Rosa, San Bernardino and Fresno district offices and with almost all water suppliers and wastewater reclamation systems in these Districts. I have also assisted in the oversight of water suppliers in the Santa Ana, Los Angeles, Stockton, Bakersfield and Berkeley offices which has given me insight into the various problems faced by all types of water systems in the State of California. I have also served on the following DPH and industry committees:

- Environmental Protection Agency (EPA) Stage 2 Disinfection Byproducts & Long-Term 2 Federal Advisory Committee (FACA2). This committee negotiated new Federal regulations that govern both Disinfection By-products (DBP) and microbial treatment techniques for all water systems. I represented the interest of the Association of State Drinking Water Administrators (ASDWA).
- DPH Water Treatment Committee (Committee Chairman). The duties of this committee included resolving any technical issues that arose related to the treatment of surface waters by all utilities in California and evaluation of proposed new treatment technologies.

- AWWARF Surface Water Treatment Rule Ad Hoc Committee (past and present committees). This committee was been formed to facilitate the issues related to implementation of existing surface water treatment regulations as well as the adoption of new regulations in California.
- AWWA Project Advisory Committee 'High Intensity and Pulsed UV Research Project'. As a member of this committee, I had the responsibility of providing a review of the results an ongoing research project that is trying to answer critical questions related to the safe use of UV technology as a primary disinfectant. The development of the new UV technologies, allowed for significant a reduction in the formation of DBPs when properly used.
- State Project Contractors Sanitary Survey Action Committee. This committee met every three months to develop guidance for the ongoing sanitary survey investigations of the State Aqueduct system.
- DPH State Revolving Fund (SRF) Oversight Committee. This committee has developed policy and regulations that will enable the DPH to fund improvement projects in California water systems which are not currently in compliance with a State or Federal drinking water regulation.
- DPH Small Water System/Local Primacy Committee.
- DPH Source Water Assessment Committee. This committee developed the Department's Source Water Assessment Program (SWAP). The first source water assessment program in the country to receive unconditional approval from EPA.
- AWWA Water Treatment Committee.
- DPH Wastewater Recycling Committee
- State Project Contractors Aqueduct Pump-in Committee. This committee was formed during the drought to set criteria for the quality of groundwater that is allowed into the State Aqueduct.
- DPH Safe Drinking Water Bond Law Oversight Committee*
- DPH Cross-connection Committee. * I was chairman of this committee when the first DPH cross-connection implementation manual was developed.
- AWWA Cross-connection Committee*
- DPH Permit Manual Committee*

*Past committee member

Participation on the various committees listed above has provided me with the experience and background needed to administer and, when necessary enforce California's laws and regulations governing water supply and wastewater reclamation utilities.

As both a Supervising and Senior Engineer in charge of a District(s) I have planned, organized and coordinated work of DPH staff, water utility personnel, local county health DPH personnel, and engineering consultants involved in improvement projects and various water utility oversight and operational programs. This has involved the entire breadth of technical problems faced by the water supply utilities of California. I have been involve in issues related to the large very sophisticated water systems to the problems encountered by very small under-funded and under staffed system. I have been

involved in various public hearings, court cases and other areas of negotiations with all type of issues related to the water utilities of California.

I have represented the DPH at various public meeting, professional conferences and workshops. I have helped to organize many of these sessions and have presented technical papers in an effort to provide outreach to the regulated water industry on issues related to DPH policy and regulations.

APPENDIX

B

Sample ID	Lab ID	Data Analysis	Method	MTBE	TBA
Well 9	810042-32	10/02/2008	8260B	<0.02	<1
Well 18	810042-26	10/03/2008	8260B	<0.02	<1
Well 27	810042-30	10/03/2008	8260B	<0.02	<1
Well 28	810042-28	10/03/2008	8260B	0.41	<1
Well No. 54 - water well	810024-15	10/03/2008	8260B	0.08	<1
Well No. 75 - water well	810042-10	10/03/2008	8260B	0.03	<1
Well 82-2	810042-21	10/03/2008	8260B	<0.02	<1
Well No. 101 - well water	810042-13	10/03/2008	8260B	<0.02	<1
Well 141	810042-03	10/03/2008	8260B	<0.02	<1
Well 141	810042-01	10/03/2008	8260B	0.02	<1
Well 154	810042-05	10/03/2008	8260B	<0.02	<1
Well 162	810042-23	10/03/2008	8260B	0.10	<1
Well 166	810042-19	10/03/2008	8260B	<0.02	<1
Well 205	810042-17	10/03/2008	8260B	0.16	<1
Well 271	810042-07	10/03/2008	8260B	<0.02	<1
Well 3	810196-41	10/17/2008	8260B	<0.02	<1
Well 4-A	810196-39	10/17/2008	8260B	<0.02	<1
Well No. 5 - well sample	810196-04	10/17/2008	8260B	<0.02	<1
Well 13	810196-37	10/17/2008	8260B	<0.02	<1
Well No. 16	810196-19	10/17/2008	8260B	0.05	<1
Well 17 Well Water	810196-35	10/17/2008	8260B	0.04	<1
Well 19A Well	810196-10	10/17/2008	8260B	0.10	<1
Well 19B Well	810196-12	10/17/2008	8260B	<0.02	<1
Well No. 20	810196-21	10/17/2008	8260B	0.15	<1
Well No. 49-A	810196-23	10/17/2008	8260B	<0.02	<1
Well No. 56 - well sample	810196-06	10/17/2008	8260B	<0.02	<1

Sample ID	Lab ID	Data Analysis	Method	MTBE	TBA
Well No. 58 - well sample	810196-02	10/17/2008	8260B	<0.02	<1
Well 70 Well	810196-16	10/17/2008	8260B	<0.02	<1
Well 74 Well Water	810196-33	10/17/2008	8260B	<0.02	<1
Well 118 Well Water	810196-31	10/17/2008	8260B	<0.02	<1
Well No. 165-2 Well	810196-14	10/17/2008	8260B	<0.02	<1
Well 192 Well Water	810196-29	10/17/2008	8260B	<0.02	<1
Well No. 193 - well sample	810196-08	10/17/2008	8260B	<0.02	<1
Well No. 203A	810196-25	10/17/2008	8260B	<0.02	<1
Well 297-2	810196-43	10/17/2008	8260B	<0.02	<1
Well No. 30 - well water	810273-02	10/24/2008	8260B	<0.02	<1
Well No. 60 - well water	810273-06	10/24/2008	8260B	0.02	<1
Well No. 219 - well water	810273-04	10/24/2008	8260B	1.20	<1
Well No. 320 - well water	810273-08	10/24/2008	8260B	<0.02	<1
Well No. 366	810273-10	10/24/2008	8260B	<0.02	<1
Well No. 367	810273-12	10/24/2008	8260B	<0.02	<1
Well No. 2-B	810300-05	10/28/2008	8260B	<0.02	<2.5
Well No. 22-A	810300-07	10/28/2008	8260C	<0.02	<2.5
Well No. 221	810300-03	10/28/2008	8260B	0.03	<2.5
Well No. 352	810300-01	10/28/2008	8260B	<0.02	<2.5
Well No. 36	811021-03	11/04/2008	8260C	0.03	<2.5
Well No. 105	811021-01	11/04/2008	8260C	<0.02	<2.5
Well 9A	102099-06	02/09/2011	524.2	<0.02	<3
Well 18A	102099-01	02/09/2011	524.2	<0.02	<3
Well 28A	102099-03	02/09/2011	524.2	0.037	<3
Well 54	102099-05	02/09/2011	524.2	0.024	<3
Well 219	102099-04	02/09/2011	524.2	0.100	<3
Well 221	102099-02	02/09/2011	524.2	<0.02	<3

Sample ID	Lab ID	Data Analysis	Method	MTBE	TBA
PS320	102112-01	02/10/2011	524.2	<0.02	<3
MW320-660	102112-02	02/10/2011	524.2	<0.02	<3
MW320-450	102112-03	02/10/2011	524.2	<0.02	<3
MW320-245	102112-04	02/10/2011	524.2	<0.02	<3

APPENDIX

C

R-44-97

**Final Statement of Reasons
Secondary Maximum Contaminant Level for Methyl tert-Butyl Ether and
Revisions to the Unregulated Chemical Monitoring List
Title 22, California Code of Regulations.**

All suppliers of domestic water to the public are subject to regulations adopted by the U.S. Environmental Protection Agency (EPA) under the Safe Drinking Water Act (42 U.S.C. 300f et seq.) as well as by the California Department of Health Services (Department) under the California Safe Drinking Act (Sections 4040.1 and 116300-116750, Health and Safety Code). California has been granted "primacy" for the enforcement of the Federal Act. In order to receive and maintain primacy, states must promulgate regulations that are no less stringent than the federal regulations.

In accordance with federal regulations, California requires public water systems to sample their sources and have the samples analyzed for inorganic and organic substances in order to determine compliance with drinking water standards, also known as maximum contaminant levels (MCLs). Primary MCLs are based on health protection, technical feasibility, and costs. Secondary MCLs are based on consumer acceptance, using parameters such as odor, taste, and appearance as measures of acceptability. The water supplier must notify the Department and the public when a primary or secondary MCL has been violated and take appropriate action. Public water systems must also sample for a number of "unregulated" chemicals, as set forth in regulation.

The Department proposes the following amendments to Chapter 15, Title 22 of the California Code of Regulations:

- To amend Section 64449, Article 16, to add the chemical methyl tertiary-butyl ether (MTBE) with a secondary maximum contaminant level (MCL) to Table 64449-A.
- To amend Section 64450, Article 17, to add ethyl tert-butyl ether (ETBE) and tert-amyl methyl ether (TAME) to Table 64450-B, limit MTBE unregulated chemical monitoring to nontransient-noncommunity water systems, and add Table 64450-D with perchlorate.
- To amend Section 64450.1, Article 17, to require monitoring at five-year intervals in conformance with federal regulations; eliminate obsolete deadlines; establish an appropriate date to use as criteria for grandfathered data for ETBE, TAME and perchlorate monitoring requirements; and make editorial corrections for text clarification.

The net effect is that:

- Community water systems would be required to monitor for MTBE to determine compliance with a secondary MCL, but would no longer be required to monitor MTBE as an unregulated chemical.

R-44-97

- Nontransient-noncommunity water systems would continue to monitor for MTBE as an unregulated chemical to determine if any contamination were present.
- Community and nontransient-noncommunity water system sources would be monitored for unregulated chemicals at five-year intervals.
- Vulnerable community and nontransient-noncommunity water system sources would be monitored for ETBE, TAME, and/or perchlorate to determine if any contamination were present.
- Water systems would be able to use ETBE, TAME and perchlorate data collected subsequent to January 1, 1993 toward initial monitoring requirement compliance.

The amendment, which would require unregulated chemical monitoring at five-year intervals, does affect California's primacy status in that it is a federal requirement and must be adopted into California's regulations. The other proposed amendments, with the exception of text clarification, would make the state's regulation more stringent than the federal, which is allowed. Therefore, these changes would not affect California's primacy status.

In addition to the above amendments, the Health and Safety Code citations in the authority/reference NOTES for sections 64449 and 64450.1 have been amended for consistency with the authority/reference NOTE updates. Further, section 64449(h) has been amended to use the technically correct reference to a subsection.

The following paragraphs describe and explain the proposed amendments.

Article 16. Secondary Drinking Water Standards
64449. Secondary Maximum Contaminant Levels

The purpose of this section is to list the chemicals for which secondary maximum contaminant levels (MCLs) have been established to protect the taste, odor and/or appearance of drinking water. Methyl tert-butyl ether (MTBE) would be added to this list with a secondary MCL of 0.005 mg/L.

MTBE is a colorless, liquid hydrocarbon that has been used as an octane booster in gasoline since the 1970s. Highly mobile in soils through which it rapidly migrates to groundwater, very soluble in water, and extremely slow to biodegrade (or possibly non-biodegradable), MTBE has been found in shallow groundwater throughout the U.S. Due to concerns regarding possible MTBE contamination of drinking water supplies in California, the Department added MTBE to the list of unregulated chemicals (22 CCR Section 64450) for which community and nontransient-noncommunity water systems are required to monitor in order to collect solid occurrence data for MTBE in drinking water sources. Data collected prior to and since the effective date of the requirement (February 13, 1997) by regional water quality control boards and drinking water utilities indicates there is some groundwater and surface water contamination in California. As of June 13,

R-44-97

1997, MTBE had been detected in 14 of the 388 systems that had monitored (26 sources). The Department is continuing to collect occurrence data and, at the same time, intends to establish appropriate drinking water standards for MTBE.

The Department has two concerns regarding MTBE from a public health standpoint: Risks to human health, and consumer acceptance of drinking water containing MTBE in terms of odor and taste. To address public health issues, the Department currently uses an action level of 35 micrograms per liter (ug/L), based on the non-carcinogenic effects seen in animal studies. This level was established in 1991 by the Pesticide and Environmental Toxicology Section which was then in the Department, but is now in Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHHA). At that time, there was very little known about the occurrence of MTBE in drinking water supplies. The action level provides non-regulatory guidance to the Department's Drinking Water Program, County Health Departments, utilities and the public about the significance of findings in drinking water of chemicals without drinking water standards.

In December 1996, EPA released a draft health advisory of 70 ug/L, based on kidney and liver effects observed in laboratory animal experiments for MTBE ("Methyl-t-Butyl Ether [MTBE] Drinking Water Health Advisory, Health and Ecological Criteria Division, Office of Science and Technology, Office of Water US EPA, Washington, D.C. 20460).

OEHHHA is reviewing the available health effects data on MTBE in order to establish a protective public health level; subsequently, the Department will propose a primary drinking water standard.

Due to its chemical properties, MTBE can be both smelled and tasted by many people at levels below both the federal and state health advisory levels discussed above. Therefore, to address the potential adverse affect of MTBE on the aesthetic quality of water, the Department has determined that a secondary MCL should be established. Under California regulations, violations of secondary MCLs require public notification and treatment. Under certain circumstances, a water utility may be able to qualify for a waiver, but to date, waivers have only been granted for existing water systems with iron and manganese problems. Adoption of a secondary MCL for MTBE would ensure that consumers are not exposed to drinking water with objectionable taste and odor related to MTBE contamination and would also ensure that MTBE levels are below current, and presumably future, health-based advisory levels.

Only two MTBE taste and odor studies have been conducted. A Great Britain study evaluated the taste and odor of a number of drinking water contaminants including MTBE ("Taste and Odour Threshold Concentrations of Potential Potable Water Contaminants", by W.F. Young, H. North, R. Crance, T. Ogden, and M. Arnott, *Water Research*, Volume 30, Number 2, 1996, pages 331-340). In this study, a panel of 9 specially selected and trained odor and taste assessors (females between ages 25 and 55) were used to evaluate known concentrations of MTBE dissolved in water. MTBE was prepared in different concentrations, diluted 2.5- to 3-fold between concentrations. Concentrations of chemicals in this study were over a 2000-fold range.

R-44-97

Results were presented in terms of the threshold concentration, that is, the lowest concentration in water for which an assessor detected an odor or taste. Rather than a simple average, the authors used the geometric, "because of the geometric interval between dilutions of concentrations and, as the best estimate, it assumes a normal distribution of sensitivities to give 50-50 divisions of a population." The lowest concentration detected by panelists was also presented. For odor detection, the average (geometric mean) threshold MTBE concentration was 34 ug/L (7 of 9 panelists; 78 percent) and the lowest concentration was 15 ug/L (3 of 9 panelists; 33 percent). For taste detection, the average (geometric mean) threshold MTBE concentration was 48 ug/L (5 of 9 panelists; 56 percent) and the lowest was 40 ug/L (4 of 9 panelists; 44 percent).

In summary, the thresholds for odor and taste of 15 and 40 ug/L, respectively, were detected by a sizable proportion of the assessment panel (33 and 44 percent). The methods of the study and the reported findings indicate that at the next lower concentration, estimated at 5 and 12.5 ug/L for odor and taste, respectively, no MTBE was detected by the assessors.

The Orange County Water District in California also performed a study on threshold odor concentrations of MTBE. The results of the study, "Threshold Odor Concentrations of MTBE and Other Fuel Oxygenates" by Y.F. Shen, L.J.Y. Yo, S.R. Fitzsimmons, and M.K. Yamamoto, was presented at a national meeting of the American Chemical Society in San Francisco in April 1997. They found geometric means of 13.5 to 43.5 ug/L, indicating that half of the panelists detected MTBE at those levels. The geometric means odor thresholds were of the same magnitude, regardless of water type (odor-free water, chloraminated tap water, or water containing free chlorine) or temperature (room temperature, 40°C, or 60°C).

The lowest MTBE concentrations in water at which odor was detected among the various test runs were 2.5, 5, and 15 ug/L. The lowest threshold of 2.5 ug/L occurred in 7 (44 percent) of 16 test runs combining water types and temperatures. A lowest odor threshold of 5 ug/L was reported in 4 tests (2.5 percent) and 15 ug/L was reported in 5 tests (31 percent). The 2.5-ug/L odor threshold was reported in: (a) 2 of 4 runs in odor free water at room temperature, and 1 of 2 at 60°C; (b) 2 of 2 runs in tap water at room temperature, and 1 of 1 run at 60°C; and community 0 of 2 in water with free chlorine at room temperature, and 1 of 1 at 40°C.

In summary, the Shen *et al* study shows that MTBE odor may be detected at levels as low as 2.5 ug/L. No lower concentration was tested. Hence, the highest concentration that would not be detected under conditions of this study is unknown, but less than 2.5 ug/L.

Shen, *et al.*, also investigated MTBE in the laboratory to check for cross contamination of laboratory samples, which is of concern since MTBE is used as a common laboratory extraction solvent. They found "background" concentrations of MTBE ranging from 0.07 to 3.12 ug/L (average 0.93 ug/L) in 40 vials containing deionized water that had

R-44-97

been placed throughout the laboratory for an unspecified period of time. This suggests that detecting very low levels of MTBE in water may be confounded by MTBE in the laboratory, which is why the Department established a detection level for the purposes of reporting (DLR) of 5 ug/L at the time that it adopted the MTBE unregulated chemical monitoring requirement.

Since MTBE's odor is detected at a lower concentration than its taste, odor is the appropriate endpoint for establishing the secondary MCL. The Department believes the study by Young *et al.* is the most appropriate for establishing the secondary MCL because it was a large study of a number of chemicals which would hopefully preclude any unintended bias that could be associated with a study focused on fuel additives conducted in a highly politicized situation. Therefore, the Department proposes a secondary MCL of 5 ug/L (0.005 mg/L) for MTBE. In addition, because of the possibility of MTBE cross-contamination in analytical laboratories, the Department believes an MCL of 5 ug/L would provide adequate protection of consumers from adverse odors (and, therefore, taste) while sparing drinking water systems from MCL violations based on spurious laboratory results resulting from laboratory contamination.

Although, as noted above, MTBE has been detected in some California drinking water supplies, at this time, there do not appear to be any active drinking water sources that would be out of compliance with the proposed MTBE secondary MCL.

The Department proposes to correct a typographical error in subsection 64449(i). The published text shows an underline (" _ ") preceding "pH"; the space immediately preceding should be blank.

Article 17. Special Monitoring Requirement for Unregulated Organic Chemicals

64450. Unregulated Chemicals

The purpose of this section is to list those chemicals for which monitoring must be conducted to determine their occurrence in drinking water supplies. The proposed regulation would amend this section in several ways: Add ethyl tert-butyl ether (ETBE) and tert-amyl methyl ether (TAME) to Table 64450-B, limit unregulated chemical monitoring for MTBE to nontransient-noncommunity water systems, and add Table 64450-D for inorganic chemicals with perchlorate listed.

Due to the concerns related to oxygenates used in reformulating gasoline, the Department is proposing to add ETBE and TAME to the unregulated monitoring section in order to collect occurrence data in California. These oxygenates, particularly ETBE which is not known to be in current use in California, are much less likely to be found in water than MTBE. However, there is still some potential for occurrence and this risk might increase in the future due to the many issues that have been raised related to MTBE that might result in its use being curtailed. TAME is known to be in current use by one refinery in some of its reformulated gasoline at 2 percent TAME to 9 percent MTBE. When used,

R-44-97

ETBE and TAME are used in small percentages along with a larger proportion of MTBE. Hence, vulnerability to ETBE and/or TAME would be determined on the basis of whether a source had an MTBE detection. Very little is known about the possible adverse health effects associated with either of these chemicals.

The proposed regulation would limit MTBE monitoring as an unregulated chemical to nontransient-noncommunity water systems because under this proposed regulation, community water systems would be conducting their monitoring under the secondary MCL requirements. Hence, only the nontransient-noncommunity water systems need to continue monitoring under this section.

Due to the recent findings of perchlorate in drinking water supplies in northern California (primarily eastern Sacramento County) and southern California (Los Angeles, San Bernardino, and Riverside Counties) by the Department through its Drinking Water Program, and the concern related to overall occurrence, the Department is proposing to add perchlorate to the list of unregulated chemicals for monitoring in order to better assess occurrence in California.

Perchlorate is an anion resulting from the chemical dissociation of industrial chemicals such as ammonium perchlorate, potassium perchlorate, and sodium perchlorate which have been in use for several decades in the manufacture of solid rocket fuel, munitions, and fireworks. Though little is known about perchlorate's behavior in the environment, it appears to be mobile in soils through which it migrates to groundwater, soluble in water, and extremely slow to biodegrade (or possibly not biodegradable). In February 1977, the Department initiated testing of highly vulnerable wells near suspect facilities and provided the supporting laboratory services; as of July 7, 1997, 232 wells from 48 systems had been sampled with perchlorate detected in 69 at levels greater than 4 ug/L, the detection limit for reporting purposes. It has also been found at low levels in the Colorado River as the result of the contamination of Lake Mead in Nevada.

The Department established a health-based action level for perchlorate of 18 ug/L in early 1997, based on its effects on the thyroid gland in a human study of non-carcinogenic effects.

The Department proposes to correct an editorial error in table 64450-B: the synonym for 1,2,3-Trichlorobenzene should read "vis-Trichlorobenzene" instead of "vic-Trichlorobenzene". The latter is a typo and is not correct.

64450.1. Monitoring – Unregulated Chemicals

The purpose of this section is to establish the monitoring requirements and criteria for monitoring waivers and exemptions for unregulated chemicals. The Department is proposing to amend this section as follows:

Subsection (a) would be amended to incorporate the requirement that monitoring be repeated at five-year intervals for conformance with federal regulations (40 CFR Section

R-44-97

141.40(l), Federal Register 52, 25715, July 8, 1987). Subsection (a) would also be amended for clarification to incorporate monitoring frequency and the specification regarding using the same sites unless Department approval is obtained from subsection (b). Specifically, paragraph (a)(1) would specify the tables of chemicals for which monitoring frequency differs according to type of source and would incorporate the requirements from the existing paragraph (a)(1) and (a)(2). The proposed paragraph (a)(2) would incorporate the existing monitoring requirement from subsection (b) for Table 64450-C and establish that monitoring frequency for perchlorate as well. The Department believes that quarterly monitoring rather than a single sample is more appropriate for perchlorate data collection because the data collected since February 1977 has demonstrated that results at a single source can vary considerably. Subsection (3) would be amended to establish an appropriate grandfathered data date for ETBE, TAME, and perchlorate data. 1993 would provide for data up to five years old to be used with repeat monitoring five years from the date of that data. The word "initial" would be added for clarification. The caveat that there should have been no detections in order to grandfather data is not actually applicable since unregulated chemical monitoring does not specify follow-up procedures for positive findings. Paragraph (a)(4) is a requirement from subsection (b), placed here for continuity.

Subsection (b) would be amended to delete the obsolete deadline for sampling and the redundant (to subsection (a)) requirement for "representative samples". The phrase "by the Department" would be added to clarify how a water system is determined to be nonvulnerable and the proposed table 64450-D would be added.

R-44-97

Appendix 1

List of Commentators

Public Comment Period Ending September 8, 1998

R-44-97

<i>Reference #</i>	<i>Commentator Name and Representation</i>
1	John Kneiss, Director, Health Sciences and Product Stewardship Oxygenated Fuels Association
2	Gene Livingston and S. Craig Hunter Livingston & Mattesich Law Corp. Attorneys for the Oxygenated Fuels Association
3	Jeff Sickenger, Environmental Issues Coordinator Western States Petroleum Association (WSPA)
4	Michael J. McGuire, Ph.D. McGuire Environmental Consultants, Inc.
5	John McKnight, Director of Environmental and Safety Compliance National Marine Manufacturers Association
6	Margaret H. Nellor, Head Monitoring Section County Sanitation Districts of Los Angeles County
7	Mark Buehler, Director of Water Quality Metropolitan Water District of Southern California
8	Andrew DeGraca, P.E., Water Quality Bureau Manager Public Utilities Commission, City and County of San Francisco
9	Nira Yamachika, Director of Water Quality Orange County Water District
10	Dan Smith, Manager of Regulatory Affairs Association of California Water Agencies (ACWA)
11	Gilbert M. Borbos, Jr., P.E., Utilities Manager City of Santa Monica Utilities Division

R-44-97

Response to Public Comments on R-44-97

No request for a public hearing pursuant to Government Code 11346.8 was received in a timely manner.

The following responses to public comments on R-44-97 are organized as follows: "Appropriate Threshold Level" includes comments/responses related to the appropriate level to use to establish the MCL (lowest level of detection in a study vs geometric mean of the levels detected in the study); "Appropriate Criteria" addresses comments/responses related to consumer acceptance criteria; "Good Science" includes comments/responses related to the scientific basis for the proposed MCL; "Cost" includes any comments related to the cost of the regulation; and "Miscellaneous" includes comments not fitting in any of the above categories.

Appropriate Threshold Level

Commentator 1 stated that the Department inaccurately defined the threshold concentration as the lowest concentration detected by an assessor. Specific points were that the Young study included results expressed not only as the lowest concentrations detected, but also as geometric means; that the ASTM method E-679 defines detection threshold differently from the Department; and that the "Standard Methods for the Examination of Water and Wastewater states that the Threshold Odor Number (TON) is the concentration of an odorant where three dilutions will produce no perceptible odor." The Department would like to note that the definition ascribed to Standard Methods is incorrectly stated, by the commentator; the definition is, "The 'threshold odor number,' designated by the abbreviation TON, is the greatest dilution of sample with odor-free water yielding a definitely perceptible odor." (Standard Methods, 19th edition, p. 2-13) Further, the Department would like to cite the dictionary's definition for "threshold": "The point at which a stimulus, as of a nerve or muscle, just produces a response." (Funk and Wagnalls, 1968) The Department is using the term "threshold for odor and taste" in the sense defined in the dictionary, i.e., as the lowest concentration at which a sensory response of smell or taste occurs.

Commentators 1 and 4 stated that the Department should use the geometric mean to establish the MCL, citing the ASTM Standard. Commentator 1 also referenced the opinion of the Expert Advisory Panel that it had used for the Malcolm Pirnie, Inc., study (1998): "...using the geometric mean to support a secondary MCL is a scientifically justifiable approach". However, the commentator has not demonstrated why a geometric mean is more scientifically justifiable than the lowest level detected. Although, the studies that investigated MTBE odor and taste present their results in terms of geometric means of the study panel, as well as lowest levels detected, the geometric mean simply indicates that the "average" person would sense MTBE at that level, based on that study's results in which half the panel reported sensing MTBE in drinking water at that level and half did not.

The Department believes that in setting a drinking water standard, it should strive to meet a higher goal for public welfare protection than only half the population.

R-44-97

Clearly, Health & Safety Code §116275(d) indicates the application of a secondary MCL to any contaminant in drinking water that "may cause a substantial number of persons served by the public water system to discontinue its use," and directs the Department to a lower level than the geometric mean for sensation of MTBE's odor or taste. Setting the standard at 5 ppb enables the water supply to remain wholesome, and protects a larger proportion of the population from the taste and odor of MTBE. Since only a small change in the proportion of the population can account for many millions of people when applied to California, it is important that such a standard be set as low as is reasonable. The Department would not be acting in the best interests of the public if it were to set a standard that could result in half the population being at risk of smelling MTBE in their drinking water. Neither would such an approach be consistent with the public welfare policy of providing protection for the entire population to the extent that that is feasible.

Commentator 1 suggested that the 7 detections at 2.5 ppb in the Orange County Water District study were likely to have been made by the same tester and that since the tester did not always detect down to this level, this reinforced the Young study statement regarding variation in sensitivity of individuals. Following this line of reasoning, the commentator then concluded that it was inappropriate to base the threshold on a single individual. The commentator has no way of knowing whether all these detections were by the same panelist, because this information was not provided in the study report. Further, a subsequent study (Shen *et al.*, 1997) found detections down to 2.5 ppb and not all by the same tester. Hence, the Department did not base the MCL on a single individual's sensitivity to MTBE in water.

Commentator 1 stated that the Young study does not support a secondary MCL of 5 ppb, because no panelists could detect MTBE at 5 ppb. Commentator 4 stated that the proposed MCL was below the lowest detectable level for a compound in a panel test. Both of these commentators appear to not be aware of the studies in which panelists detected levels less than 5 ppb. Although no panelists in the Young study detected at 5 ppb, the 1997 study by Shen *et al.* showed MTBE odor detected by individual panelists at levels as low as 2.5 µg/L. The lowest concentrations of MTBE in water at which odor was detected among the 24 test runs in the 1998 Orange County Water District study were: 2.5 ppb (6/24, 25 percent), 5 ppb (4/24, 17 percent), 10 ppb (7/24, 29 percent), 20 ppb (2/24, 8 percent), or 30 ppb (1/24, 4 percent). No concentration lower than 2.5 ppb was tested in either study. Hence, the highest concentration that would not be detected by an individual under conditions of these studies is unknown (but less than 2.5 µg/L.). Subsequently, the Malcolm Pirnie study results showed 10 of the 57 panelists able to sense MTBE odor down to 2 ppb.

The Department would like to note that under the secondary MCL regulations (22 CCR Section 64449), a water utility may obtain a waiver for the MTBE secondary MCL if it were able to document that the community being served by the water utility "accepted" the odor and/or taste of MTBE in preference to paying to remove it. This would address issues related to local sensitivities, water quality, and economic considerations.

R-44-97

Appropriate Criteria

Several commentators addressed the criteria used to determine an acceptable level for the MCL related to consumer acceptance and objectionable odors. In addition, commentator 3 stated that the Department should establish objective secondary standard setting criteria. Commentator 7 urged the Department to set a standard that protects consumers from objectionable water and stated that reliable threshold data and a determination of an objectionable concentration level are critical in establishing the MCL. Commentator 10 stated that it believed that the studies available support a conservative standard and that it supports the use of good science in rulemaking. The Department agrees with these comments and believes that they have been addressed during the standard setting process, as well as below.

Commentator 1 stated that the Department did not discuss "consumer acceptability" in the documentation, yet stated a goal of ensuring that consumers were not exposed to objectionable taste and odor related to MTBE in their drinking water. The commentator went on to note that common descriptor words used for MTBE in taste and odor tests were "estery," "vanilla," "sweet," "bitter" and "sweet solvent" and, hence, the taste or odor "is likely not objectionable, and would not, therefore, affect consumer acceptability of drinking water." The Department believes that its "goal" reflects the appropriate public health agency policy position and, therefore, did not discuss whether such tastes or odors would be "acceptable" to the consumer. The commentator implies that because testers selected the words "vanilla" and "sweet" and "sweet solvent" to describe the tastes and odors they were detecting, that they would not object to drinking such waters from their home taps. From the Department's experience, any indication in a drinking water that a contaminant is present is generally highly objectionable to the consumer, even if reassured that no health risk is posed. In addressing the effect of a contaminant on odor or taste, the Department would not give deference to a pleasant tasting contaminant over one that is less pleasant, nor to a level of a specific contaminant that is pleasant tasting over a level that is not. Furthermore, the public will find objectionable any odor and taste that it has learned to identify with MTBE or any other chemical. In addition, existing regulations allow water systems the option of requesting a waiver from compliance with the secondary MCL if their customers accept drinking water exceeding the MCL.

Commentator 2 stated that studies conclude that odors at levels greater than 5 ppb are not objectionable. The commentator does not specify to which studies he refers. It may be that he is referring to the above descriptors used by panelists and has concluded that they would not object to having the test waters coming from their home taps; there are no data to substantiate this conclusion.

Commentator 2 stated that the Department exceeded the scope of Health and Safety Code sections 116275(d) and 116610(d), both of which provide criteria for establishing a secondary MCL for MTBE. The first section mandates that the Department set secondary MCLs to protect public welfare for any contaminant that adversely affects the odor or appearance, causes a substantial number of persons to discontinue use or otherwise adversely affects public welfare." The second section mandates that the

R-44-97

MTBE secondary MCL be set at a level that does not exceed the consumer acceptance level. The Department believes that it has acted consistently with these mandates: Based on the studies available, MTBE does adversely affect the odor (as well as taste) of water, could cause a substantial number of persons to discontinue use, and, by its presence, could adversely affect public welfare. Based on its role as a public health agency, the Department believes that establishing an MCL for MTBE of 5 ppb will ensure that the consumer acceptance level of the large majority of the population is addressed. As previously noted the MCL can be waived if consumers accept drinking water in excess of the MCL.

Commentator 2 stated that the Department should look for guidance to the 'counterpart federal scheme, and to the interpretations thereof...' because the California statutes were passed to carry out the federal mandates. Commentator 3 stated that the Department should look to other federal, state and local agency programs. When appropriate, the Department does refer to federal guidance. However, California is not precluded from adopting more stringent standards than those recommended at the federal level. In fact, California has adopted several MCLs that are more stringent than the federal counterpart. In the case of MTBE, the Department believes that an MCL which is more stringent than the federal guidance is necessary to ensure public acceptance and protect against adverse affects to the public welfare.

Good Science

Commentators 7 and 10 stated that the Department should use "good science" in establishing the MCL. Commentators 1, 2 and 3 noted that the Department mentioned only two MTBE taste and odor studies; the first commentator listed four others. Commentator 3 stated that the Department did not take into account the Malcolm Pirnie study. Although the Department did not mention the Arco and API studies, it had reviewed the findings of both and gave less weight to them because the lower levels of sensation detection were established by statistical projection as opposed to the Shen, *et al.*, 1997 study and the Young, *et al.* study. The Shen and Young studies exposed panelists to lower concentrations of MTBE. The Malcolm Pirnie study was not completed and was not available at the time the regulation package was developed. However, the Malcolm Pirnie study was submitted during the comment period and was reviewed. The Department believes that the Malcolm Pirnie study supports establishing an MCL of 5 ppb.

Commentator 2 stated that the Department has failed to establish a scientific necessity for an MCL that is so restrictive and that "has relied on a single, fatally flawed taste and odor test", and that it has "cherry-picked" the Young study findings, ignoring those portions that compel a higher standard. This commentator also stated that the Malcolm Pirnie study should be the basis of a 15 ppb standard since its testers consisted of untrained California residents. Commentator 3 noted the lack of documentation of consumer complaints for MTBE in drinking water and that the available taste and odor studies did not use naturally occurring substances common to California groundwater supplies which can mask MTBE. These comments are addressed in the paragraphs below.

R-44-97

Commentator 1 provided a copy of the Malcolm Pirnie study that it funded. A number of commentators (1, 2, 3, 4, and 6) recommended that the Department base the MCL on this study. Commentator 1 made the following statements regarding the study: That it is the only one conducted on consumer panelists with a large statistical population, that study results should be more representative of the general California population than those of other studies, that the results fall within the same range as those from other studies with one exception, that the commentator's Expert Advisory Panel agreed that this was the best study; and that the study's geometric mean should be used as the basis for the MCL instead of the lowest level detected. The Department has reviewed the Malcolm Pirnie study, which used a panel of 57 subjects, roughly half male and half female, from 18 to 65 years of age. Panelists were exposed to MTBE at concentrations in water from 2 to 100 ppb.

Based on the data from this study (Table 3.2), the lowest concentration detected by individual panelists was 2 ppb MTBE, and this was sensed by 10 of 57 panelists (18 percent). The percentage of panelists indicating they sensed MTBE increased with increasing MTBE concentration, as follows: 6 ppb (18/57, 32 percent), 10 ppb (22/57, 39 percent), 18 ppb (31/57, 54 percent), 30 ppb (38/57, 67 percent), 60 ppb (44/57, 77 percent), and 100 ppb (49/57, 86 percent). The geometric mean of the data was 14.5 ppb.

These data clearly indicate that using the geometric mean as the basis for the MCL would potentially result in a much higher percentage of consumers detecting MTBE than at the proposed MCL of 5 ppb. Therefore, the Department does not believe that using the geometric mean would ensure consumer acceptance or avoid adversely affecting the public welfare.

Commentator 1 stated that a statistical analysis of the Malcolm Pirnie data by Dr. Richard Berk of UCLA showed that any correct detection below 22 ppb was the result of either guessing or identification by the most sensitive 5% of the population. It is not clear how Dr. Berk drew this conclusion. When it received the report by Malcolm Pirnie in July 1998, the Department requested information on the methods used by the consultant to estimate guessing, since, as Dr. Beck suggested in the Malcolm Pirnie report, the basic method used in the study (ASTM Method E679-91) appears to already account for guessing. No additional information was received by the Department prior to the close of the comment period.

The ASTM approach to guessing would not consider a positive sensation of MTBE to be "positive" if a "negative" occurred at a higher concentration. For example, if a panelist reported MTBE at 2 ppb, but not at 3.5 ppb, and then at 5, 10, and higher concentrations, that panelist's "threshold" would be 5 ppb, not 2 ppb. Making these adjustments (using the information presented in Table 3.2 of the Malcolm Pirnie report), the number of panelists sensing various levels of MTBE becomes: 2 ppb (10/57, or 18 percent, 3.5 ppb (10+0 [panelists sensing MTBE at this concentration plus those at lower concentrations]=10/57, 18 percent) 6 ppb (10+0+8=18/57, 32 percent), 10 ppb (10+0+8+4=22/57, 39 percent), 18 ppb (10+0+8+4+9=31/57, 54 percent), 30 ppb

R-44-97

($10+0+8+4+9+7=38/57$, 67 percent), 60 ppb ($10+0+8+4+9+7+6=44/57$, 77 percent), and 100 ppb ($10+0+8+4+9+7+6+5=49/57$, 86 percent).

The Malcolm Pirnie study treated 8 of the 57 panelists as not having identified MTBE as being present at even 100 ppb, and assigned them a value of 132.3 as an individual threshold. However, these eight panelists also indicated MTBE as being present in one or more tests lower than 100 ppb. Specifically the eight panelists gave a positive response in the following number of tests (out of eight different MTBE concentrations): 3, 2, 4, 5, 3, 1, 3, and 3. Two of the eight identified MTBE at 2 ppb, and the rest at higher concentrations, though all were assigned the 132.3-value.

In summary, the study by Malcolm Pirnie found a geometric mean of 14.5 ppb for MTBE odor sensation, while a significant fraction of the 57-member panel indicated that MTBE could be sensed at levels as low as 2 ppb. These results were not inconsistent with other studies reviewed and, therefore, they suggest that even if some of the other studies had limitations, their results were within a reasonable range and definitely not inapplicable to California waters and consumers. Hence, the Department has concluded that the Malcolm Pirnie study further supports the proposed MCL of 5 ppb.

Clearly, the primary point of difference between the commentators and the Department relates to whether the standard should be set to protect half the population or a larger portion of the population. As stated above under "Appropriate Level", the Department, as a public health agency, must act to protect the greatest portion of the consumer population as is feasible, and, therefore, the Department believes establishing the secondary MCL at 5 ppb is appropriate.

Commentator 1 stated that USEPA "urged water utilities" in 1989 to use the 3 TON standard as a criteria for odor in finished drinking water, i.e., a concentration of odorant 3 times greater than the maximum level of no perception, but the Department has used a 1 TON standard which is "needlessly conservative". The commentator also stated that the Department is establishing a dangerous precedent of setting chemical-specific standards based on criteria that is not accepted by any scientific body; both ASTM and Standard Methods specify a taste and odor result that is greater than the lowest perceived concentration detectable by a single panel member; and the Department should use a rigorous scientific method. The context for the statement attributed to USEPA is not provided, so the Department is unable to adequately address this comment. The commentator's comment regarding establishing a dangerous precedent implies that ASTM and Standard Methods provide criteria for setting a secondary standard, which they do not. These methods simply address procedures for determining odor thresholds in water samples. For example the TON is conducted by water treatment operators who have developed expertise by repetitively conducting the same test on the same water to identify a known sensation.

When it began the process of establishing a secondary MCL, the Department initially considered the study by Young et al., 1996, to be the most appropriate for establishing a concentration at which no odor would be detected. The 1997 study by Shen et al.,

R-44-97

suggested that MTBE could be sensed at lower levels, less than 2.5 ppb, but the Department felt that given the attention focused on MTBE and problems of local ground water contamination, there might have been some unintentional bias that entered into the California study, compared to the British study that investigated MTBE along with many other substances. In addition, the Department also felt that intralaboratory contamination issues should be addressed; within that context, a secondary standard lower than 2 ppb would be too restrictive. The Department believed that an MCL of 2 ppb would bring with it a potential for false positives and a need for drinking water systems to investigate contamination where there might be none.

However, with the additional studies by Dale *et al.*, (1997), Shen *et al.*, (1998), and Malcolm Pirnie the Department recognizes that certain individuals, and in some cases a fairly high proportion of them, are able to sense MTBE at levels as low as 2 ppb.

Consequently, based on a need to protect the public welfare, to protect against the odor and taste of MTBE, and to assure that a substantial number of persons served by the public water system would not discontinue their use of drinking water from public water systems, and considering the totality of information from MTBE odor and taste studies, the Department believes that it could justify a level of MTBE lower than the proposed 5 ppb. Commentator 4 claimed he could design studies to include sensitive people able to detect very low levels of MTBE and wanted to know how the Department would proceed if it had such data. In this case, the Department did consider revising the proposed secondary MCL downward to 1 ppb, based on the more recent studies, in order to protect a larger portion of the population than would be protected by 5 ppb. However, the Department decided not to do so, because the lower level would raise the potential for false positives and consequently unnecessary investigations of contaminant sources. Hence, more data at lower levels does not necessarily lead to a lower standard since there are other considerations; however, given the Department's policy related to protecting the largest percentage of the population as is feasible, the additional studies providing data at low levels further substantiates the need to set the MCL no higher than 5 ppb.

Cost

Commentator 3 stated that the Department did not consider the cost to public water systems to upgrade their facilities in order to comply with the proposed secondary MCL. At the time that the regulation package was developed, there were no active drinking water sources that would have been out of compliance with the proposed standard. Since the costs of a regulation are generally developed within the context of known parameters, not hypothetical, the Department did not address this issue. Further, based on data collected to date and the actions taken by the few utilities with MTBE-contaminated sources, the Department does not anticipate that many drinking water sources will actually require treatment.

Commentator 3 stated that the Department did not address whether the proposed MCL would impose a mandate of a local agency to provide a new or increased level of service and that it should have done so since improved water quality could constitute an

R-44-97

increased level of service. The Department did address this issue in the "Local Mandate Determination" and determined that any costs that might result would not be due to a "new program or higher level of service" within the meaning of Article XIII B, Section 16 of the California Constitution because they apply generally to all individuals and entities that operate public water systems in California and do not impose unique requirements on local governments.

Commentator 3 stated that the Department ignored costs associated with anticipated widespread application of the proposed MCL as a default cleanup level by regional and local water agencies. The Commentator further stated that the Department was required to determine the cost to private businesses to remediate MTBE impacted sites and attached a cost analysis comparing the cost increase at leaking underground storage tank remediation sites at the proposed 5 ppb MCL and the Malcolm Pirnie recommended MCL of 15 ppb. Commentator 6 stated that the Department failed to address the impact on wastewater or reclaimed water sources. Since the proposed MCL regulation is directly applicable to only public drinking water systems, the Department is not required to address any other costs than those resulting from that application. Furthermore, to do so is speculative and becomes more so as the effect ripples out from the regulated community. There would be no end to such an analysis.

Commentator 3 stated that the Department did not determine the fiscal impact on California businesses, then added that the Department concluded that no jobs would be eliminated. The Department refers the commentator to the "Fiscal Impact" statement in which it addressed the fiscal impact on the businesses directly impacted by the regulation (i.e., private drinking water systems) and the "Business Impact" statement in the proposed regulation package. The conclusion that no jobs would be eliminated is accurate in terms of those to which this regulation directly applies. As noted above, the Department is only required to estimate the fiscal impact to those businesses to which the regulation directly applies.

Commentator 3 did not agree with the Department that this regulation would not result in the creation or elimination of water systems. The Department's experience with previously adopted MCL regulations is that water systems are not eliminated as a result, but rather, approaches to compliance are worked out since the community needing the water supply continues to exist.

Commentator 3 stated that the waiver procedures for secondary standards would have no practical application if the economic impact considerations were limited to incremental monitoring costs. The commentator apparently does not understand that the waiver considerations address only the cost of treatment, not monitoring costs.

Commentator 3 stated that the Department provided no guidance on determining what level of incremental cost is appropriate to meet the secondary MTBE MCL. The Department assumes that the commentator is suggesting that the Department should have "appropriate level of cost" criteria for compliance with a secondary MCL such as the criteria that EPA has developed for primary MCL treatment costs to consider the impact

R-44-97

on smaller water systems. The Department does not feel that such an analysis is necessary since existing regulations allow for waivers to secondary MCLS. One of the factors considered by the customers in determining whether to have the water system seek a waiver is the cost to meet the secondary standard.

Commentator 3 stated that the Department did not analyze any alternatives to the proposed standard, nor analyze the economic impact of potential alternatives. As noted above, the Department approached the standard-setting process from a public welfare perspective related to the provision of a water supply that is pure, wholesome and potable. Analysis of available data indicated that the appropriate standard to meet that objective was 5 ppb. The Department did consider other alternative levels but determined that no other alternative level would feasibly meet that public welfare objective.

Commentator 3 stated that the Department's "implicit goal of protecting 100% of the population is inconsistent with statutory requirements, unnecessarily conservative and unreasonable from an economic impact perspective." The Department goal is to achieve protection for the greatest portion of the population that is feasible. The Department believes that the proposed MCL achieves that goal. The commentator's concern related to economic impact is primarily associated with the potential impact on dischargers if the MCL is utilized as criteria by the Regional Boards and other agencies. The Department's responsibility is to ensure that drinking water quality is protected, not try to anticipate if, how, when, or where the drinking water standards may be applied beyond the public drinking water systems that are addressed in the regulation.

Commentator 5 stated that a stringent standard would have serious economic consequences for small California recreational marine dealers, far exceeding the fiscal impacts noted in the regulation package. The Department is aware that secondary and tertiary impacts may occur although these impacts are not addressed in the analysis since marine dealers are not directly affected by this regulation, i.e., the regulation does not contain any requirements with which the marine dealers must comply.

Commentator 8 stated that the Department did not address the cost of ETBE, perchlorate, and TAME analyses in the business impact section. The Department definitely addressed this cost in the business impact section; specifically mentioning anticipated percentages of systems expected to monitor, the monitoring cost, etc.

Commentator 8 stated that the fiscal impact section's overall governmental estimates appear to be low, but provided no specific comments. The Department followed normal procedures for developing these costs which are basically a function of the number of water systems operating under government agencies. As far as the Department knows, the cost estimates represent a reasonable estimate.

R-44-97

Miscellaneous Comments

Commentator 1 noted that the Department stated that the Young study methods and reported findings indicate that at the next lower concentration, estimated at 5 and 12.5 ppb for odor and taste, no MTBE was detected by the assessors; the commentator believes that the second level should be 15, based on the dilutions. The Department agrees that this could be possible but it is not possible to conclude that based on the data available

Commentator 1 noted that the Department incorrectly stated that Orange County Water District found geometric means of 13.5 to 43.5 ppb and that the second mean was actually 45.4 ppb. The Department agrees.

Commentator 9 asked the Department to specify detection limits for purposes of reporting (DLRs) for MTBE, TAME, ETBE, and perchlorate. The Department has incorporated DLRs for these chemicals in its laboratory data reporting process. However, the Department does not put DLRs in regulation until a primary MCL is adopted. It is anticipated that a DLR of 3 ppb will be proposed when the primary MCL for MTBE is proposed.

Commentator 9 asked the Department for dates to initiate or complete MTBE, TAME, ETBE, and perchlorate monitoring. MTBE monitoring should be coordinated with other secondary MCL monitoring done by a system. TAME, ETBE and perchlorate are required only for vulnerable sources; monitoring for TAME and ETBE can be coordinated with any other volatile organic chemical monitoring being conducted by the system, while perchlorate requires a unique method and, if required to monitor, a system should move to do so as directed by the Department. Guidance on these matters will be provided.

Commentator 9 suggested that if MTBE is detected, repeat monitoring should be required to track MTBE migration and requested repeat monitoring guidance. Secondary MCL monitoring does not include repeat monitoring because it is a non-health issue. A water system may conduct this type of monitoring if it wishes.

Commentator 11 expressed support for the proposed MCL of 5 ppb and monitoring for TAME, ETBE, and perchlorate.

Commentator 6 recommended that the Department create a policy for reclaimed water dischargers for compliance or exempt reclaimed water from the secondary drinking water provisions unless direct potable reuse is planned. The Department reminds the commentator that this regulation does not require compliance from reclaimed water dischargers.

Commentator 6 stated that the Department needs to address reclaimed water issues related to the proposed MCL, as well as revisit older MCLs. Since this regulation applies

R-44-97

directly to only public drinking water systems, addressing reclaimed water issues within this context would not be appropriate. However, when the Department proposes regulations for reclaimed water, under separate statutory authority, the commentator should make a point of bringing up these issues.

Commentator 8 stated that he supports the use of grandfathered data; the Department appreciates this information.

Commentator 8 is not clear whether one year of quarterly samples per site is required every five years or one year of quarterly samples per site initially and then only one sample per site every five years thereafter (reference section 64450.1). Initial and repeat monitoring at five-year intervals follow the same sampling scenario in terms of number of samples. The Department believes that the regulation text is clear on this point.

Commentator 5 requested that the Department hold a public hearing to provide an opportunity for further comment. Unfortunately, this request was not received until the close of the comment period on September 8, 1998. In order to have been considered, pursuant to Government Code 11346.8, the request would have had to have been received by the Office of Regulations no later than 15 days prior to the close of the comment period. This deadline was noted in the notice for this regulation package.

Commentators 2 and 5 recommended that the Department utilize the USEPA nationwide drinking water advisory recommending a limit value range of 20 to 40 ppb. In 1997, USEPA published this consumer acceptance advisory, "...recognizing that some people may detect the chemical below this range." The Department believes that the concentration of MTBE at the EPA advisory level is too high to protect customers from the undesirable odor and taste effects of MTBE in drinking water, particularly in view of the 1998 studies by Shen *et al*, and Malcolm Pirnie, Inc., cited above.

Commentator 4 stated that the Department "opens itself to concerns that can be raised due to bias" since the Young study used to derive the MCL had an all-female panel. Except for this commentator, no one has made any reference to the all-female panel. The Young study was a scientific study using a panel of trained testers who happened to be all-female. The Department is not aware of any information that indicates females are more or less sensitive to MTBE than males. Therefore, the Department does not believe that there is any issue here.

Commentator 3 recommended that the Department give flexibility to water utilities by establishing a range of concentrations as a function of geographic and other circumstances that may affect water quality rather than a fixed standard. The Department does not believe that such an approach would be appropriate for a chemical contaminant affecting the odor of a drinking water supply. The commentator suggested that an appropriate concentration within the range could be selected depending on the specific circumstances of the water supply, but did not elaborate as to what those might be or how such a standard could be implemented. As noted previously, existing regulations provide

R-44-97

for flexibility by allowing waivers from secondary MCLS based on consumer acceptance and cost of compliance.

Commentator 3 recommended that the Department subject the proposed secondary MCL to a formal peer review process prior to adoption. The Department has found that the public comment period for proposed regulations for both primary and secondary MCLs is quite adequate as a review process.

Commentator 3 stated that the Department should establish implementation guidelines for drinking water well treatment and site remediation and preferably include them in the regulations. When the Department proposes a primary MCL for MTBE, it will also propose a best available technology (BAT); at this time, air stripping is the only technology that meets the statutory criteria for BAT in California. The Department is responsible for drinking water treatment, not site remediation; hence, it would be inappropriate to address site remediation in regulations promulgated by the Department.

State of California

Department of Health Services

Memorandum

Date: November 5, 1997

To: Drinking Water Program
Regional and District Engineers

From: Division of Drinking Water and
Environmental Management

Subject: Policy Memo 97-005 Policy Guidance for Direct Domestic Use of Extremely
Impaired Sources

A. General Philosophy

The primary goal of the Drinking Water Program (DWP) is to assure that all Californians are, to the extent possible, provided a reliable supply of safe drinking water. In furtherance of this goal, the DWP continues to subscribe to the basic principle that only the best quality sources of water reasonably available to a water utility should be used for drinking. When feasible choices are available, the sources presenting the least risk to public health should be utilized. Furthermore, these sources should be protected against contamination. Whenever possible, lower quality source waters should be used for nonconsumptive uses, such as irrigation, recreation, or industrial uses, which pose lower health risk.

The use of contaminated water as a drinking water source always poses a greater health risk and hazard to the public than the use of an uncontaminated source because of the chance that the necessary treatment may fail.

The use of an extremely impaired source should not be approved unless the additional health risk, relative to the use of other available drinking water sources, are known, minimized, and considered acceptable.

Water utilities (including wholesalers) should be encouraged to minimize the concentration of man-made toxic substances, naturally occurring contaminants, and pathogenic microorganisms in drinking water supplies, maximum contaminant levels (MCLs) notwithstanding.

Extremely impaired sources that contain or are likely to contain high concentrations of contaminants, multiple contaminants, or unknown contaminants (such as groundwater subject to contamination from a hazardous waste disposal site) should not be considered for direct human consumption where alternatives are available.

Where reasonable alternatives are available, high quality drinking water should not be allowed to be degraded by the planned addition of contaminants. In other words, the MCLs should not be used to condone contamination up to those levels where the addition of those contaminants can be reasonably avoided.

Regional and District Engineers
Page 2
November 5, 1997

Drinking water quality and public health shall be given greater consideration than costs or cost savings when evaluating alternative drinking water sources or treatment processes.

The DWP recognizes that there are extremely impaired sources in California that need to be cleaned up and for which the resulting product water represents a significant resource that should not be wasted. In some situations, it may be reasonable to consider the use of these treated extremely impaired sources for domestic use. Some communities may not have any choice. In such cases, the public health principles as set forth in this policy should be used to guide the evaluation of such situations.

B. Purpose of Policy Guidance

The purpose of this guidance document is to set forth the position and the basic tenets by which DWP would evaluate proposals, establish appropriate permit conditions, and approve the use of an extremely impaired source for any direct potable use.

An extremely impaired source meets one or more of the following criteria:

- exceeds 10 times an MCL or action level (AL) based on chronic health effects,
- exceeds 3 times an MCL or AL based on acute health effects,
- is a surface water that requires more than 4 log *Giardia*/5 log virus reduction,
- is extremely threatened with contamination due to proximity to known contaminating activities
- contains a mixture of contaminants of health concern
- is designed to intercept known contaminants of health concern.

Examples include:

- Extremely contaminated ground water
- Effluent dominated surface water
- Oilfield produced water
- Water that is predominantly recycled water; urban storm drainage; treated or untreated wastewater; or agricultural return water
- Products of toxic site cleanup programs

It is recognized that the circumstances surrounding each situation may be different. Proposals for the use of extremely impaired sources, therefore, must be considered on a case-by-case basis.

C. Elements of an Evaluation Process for an Extremely Impaired Drinking Water Source

1. Source Water Assessment:

Regional and District Engineers
Page 3.
November 5, 1997

The purpose of the source water assessment for the extremely impaired source is to determine the extent to which the aquifer or surface water is vulnerable to contaminating activities in the area. There may be other contaminants associated with activities that contribute to the known contamination, or other contamination sources that have yet to impact the drinking water source. There may not be drinking water MCLs, AIs or monitoring requirements established for these additional contaminants, but health related information may be available through other programs. The appropriate level of monitoring and treatment to produce a safe drinking water cannot be determined unless the activities that are affecting or may impact raw water quality are understood. The assessment should include:

- Delineation of the source water capture zone
- Identification of contaminant sources
 - Identify the origin of known contaminants found in the source water and predict contaminant level trends
 - Identify chemicals or contaminants used at or generated by facilities responsible for the known contamination
 - Identify all potential contaminant sources and determine the vulnerability of the water source to these contaminant sources

2. Full characterization of the raw water quality:

The appropriate level of monitoring and treatment to produce a safe drinking water cannot be determined unless the raw water quality is fully understood. The following categories should be considered to fully characterize the source water quality:

- Title 22 drinking water regulated and unregulated chemicals
- All chemicals for which drinking water action levels are established
- All chemicals listed pursuant to Safe Drinking Water and Toxic Enforcement Act of 1986
- Microbiological quality
- Priority pollutants
- Gross contaminant measures [total organic carbon (TOC), etc.]
- Any compounds identified under source water assessment.
- Determine variability of contaminant concentrations with time (seasonal and long term)
- Determine variability of contaminant concentrations with pumping rate.
- The detection of any contaminant identified in the raw water quality characterization (step 2) should require assessment of the impact on the source water pursuant to the source water assessment (step 1).

3. Source Protection:

There must be a program in place to control the level of contamination. At a minimum, best management practices for waste handling and waste reduction should be required. In addition, monitoring at the source should be conducted to determine the level of contamination

Regional and District Engineers
Page 4
November 5, 1997

and to reasonable assure that the contamination level will not increase. Unless the level of contamination is known a determination cannot be made that the proposed treatment is sufficiently adequate and reliable to render the water potable.

If the use of an extremely impaired source is to be approved, the source of the contamination must be controlled to:

- Prevent the level of contamination from rising.
- Minimize the dependence on treatment.

4. Effective Monitoring and Treatment:

The treatment process used to treat the extremely impaired source prior to direct usage in a domestic water distribution system must be commensurate with the degree of risk associated with the contaminants present. As a minimum, treatment of extremely impaired sources shall include use of the best available treatment technology defined for the contaminant(s) by the Environmental Protection Agency. Furthermore, the treatment processes must have reliability features consistent with the type and degree of contamination.

All treatment processes used must be optimized to reliably produce water that contains the lowest concentration of contaminants feasible at all times. The entire flow from the extremely impaired source must pass through the complete treatment process or processes. Any water from other sources that is available for blending prior to entry into the distribution system should be used to provide an additional safety factor.

Multi-barrier treatment is a set of independent treatment processes placed in series, and designed and operated to reduce the levels of a contaminant. Each barrier should effectively reduce the contaminant by a significant fraction of the total required reduction. The treatment processes should address all the contaminants of public health concern in an extremely impaired source. Multi-barrier treatment may be appropriate when:

- The primary treatment is not sufficiently reliable;
- The primary treatment is of uncertain effectiveness;
- There is no direct way to measure the contaminant (e.g., pathogenic microorganism);
- The health effect of the contaminant is acute; and/or
- Very large reductions in contaminant concentration are required.

The description of the proposed monitoring and treatment should include the following:

- Performance standards (field measurable indicator of treatment efficiency);
 - Identify level to assure compliance with the treatment objective
 - The treatment objective for all contaminants should be optimized to the lowest extent feasible and must assure compliance with the MCL/AL at all times.

Regional and District Engineers
Page 5
November 5, 1997

- Facilities for treating water containing specific contaminants for which the MCL is higher than the maximum contaminant level goal (MCLG) should be designed and operated to meet the MCLG where this can be accomplished in a cost effective manner.
- Operations plan that identifies all operational procedures, failure response triggers, and loading rates, including:
 - Process monitoring plan
 - Process optimization procedures
 - Established water quality objectives or goals
 - Level of operator qualification
- Reliability features
 - Response Plan for failure to meet the treatment objective
 - Alternative disposal methods
 - Shutdown triggers and restart procedures
- Compliance monitoring and reporting program
- Notification plan
- Extremely impaired source water quality surveillance plan

The water quality surveillance plan should include monitoring between the origin of the contamination and the extremely impaired source that is proposed for drinking water.

5. Human Health Risks Associated with Failure of Proposed Treatment:

Treatment technologies are not failure proof, and insufficiently treated or untreated water may, on occasion, pass through the treatment process and into the distribution system. An assessment must be performed that includes:

- An evaluation of the risks of failure of the proposed treatment system.

The proposed treatment system must be evaluated in terms of its probability to fail, thereby exposing customers to insufficiently treated or untreated drinking water from the extremely impaired source.

All treatment failure modes are to be evaluated. The evaluation must include an assessment of the proposed frequency of monitoring as it relates to protection of the public from insufficiently treated or untreated drinking water.

- An assessment of potential health risks associated with failure of the proposed treatment system. The health assessment must take into account:

Regional and District Engineers
Page 6
November 5, 1997

- o the duration of exposure to contaminated drinking water that would result from such a failure
- o the human health risks associated with such exposure to insufficiently treated or untreated water over the course of that failure, considering the risks of disease from microbiological organism, and the risks of acute and chronic effects (including cancer risks) from chemical contaminants
- o potential cumulative risks, due to multiple failures

When risks of adverse health effects from treatment failure are not acceptable, then additional treatment safeguards must be used for the protection of public health, or the proposal must be rejected.

6. Identification of alternatives to the use of the extremely impaired source and compare the potential health risk associated with these to the project's potential health risk.

Use of alternative sources of drinking water reasonably available to a water utility should be evaluated as to health risk (assuming MCLs are, or can be, met), and compared to the use of the extremely impaired source.

In evaluating the relative risk comparison of the extremely impaired source and alternative drinking water sources, additive effects of multiple contaminants are an important consideration. Generally, consideration of allowing direct potable use of an extremely impaired source should be limited to a single toxic contaminant or a limited number of similar chemicals that can be reliably treated with the same process.

The comparison of alternatives should include a comparison of the risks of treatment failure for the alternatives, as well as for the extremely impaired source (step 5).

7. Completion of the California Environmental Quality Act (CEQA) review of the project:

CEQA review of the project must be completed.

8. Submittal of a permit application:

The public water system(s) collecting, treating and distributing water from the extremely impaired source must submit a permit application for the use of the extremely impaired source that includes the items identified above. A supplier of treated water to a public water system is a water wholesaler and must be permitted as a public water system, as required by the Safe Drinking Water Act.

Regional and District Engineers
Page 7
November 5, 1997

9. Public hearing:

A public hearing must be held to identify concerns of consumers who will be served water from the extremely impaired source and to assure that all parties have a chance to provide relevant information.

10. DHS evaluation:

DHS staff shall conduct an evaluation of the application and make recommendations.

11. Requirements for DHS approval:

The following findings are required of DHS for approval to use an extremely impaired source:

- Drinking water MCLs and AIs will not be exceeded if the permit is complied with, and
- The potential for human health risk is minimized, and the risk associated with the project is less than or equal to the alternatives.

12. Issuance or denial of permit:

DHS either issues a permit or denies a permit for the use of the extremely impaired source. If a permit is issued, it shall include all necessary treatment, compliance monitoring, operational, and reporting requirements.

<Original signed by>

David P. Spath, Ph.D., P.E., Chief

APPENDIX

D

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

ORDER NO. R5-2008-0149

WASTE DISCHARGE REQUIREMENTS
GENERAL ORDER FOR
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM
AND/OR PETROLEUM HYDROCARBONS

The California Regional Water Quality Control Board, Central Valley Region, (hereafter Regional Water Board) finds that:

1. Pursuant to Section 13263, subdivision (i) of the California Water Code (CWC), the Regional Water Board may prescribe general waste discharge requirements (WDRs) for discharges produced by similar operations, involving similar types of wastes, and requiring similar treatment standards.
2. Discharges of volatile organic compounds (VOCs), perchlorate, pesticides, semi-volatile compounds, hexavalent chromium and petroleum hydrocarbons have degraded groundwater at numerous sites within the Central Valley Region and cause or threaten to cause pollution or nuisance and adversely affect existing and potential beneficial uses of groundwater resources. Remediation of groundwater at these sites includes the use and application of in-situ biological, chemical, and physical treatments. These processes include oxygen enhancement, chemical oxidation, biostimulation (addition of nutrients and bacteria to enhance biodegradation), bioaugmentation (introducing appropriate bacteria) and groundwater extraction and sometimes treatment, with return of treated groundwater to the area in the aquifer undergoing treatment. The application of the amendments can be done actively with hydraulic control of the treatment zone as the amendments are added to the extracted groundwater and injected upgradient into the treatment area. The application is also done at times in a passive mode where the amendments are injected into the treatment zone and there is no nearby hydraulic control of the treatment zone. Additional details are supplied in the Information Sheet, attached to this Order.
3. Adoption of general WDRs for these processes would: a) simplify the application process for dischargers, b) prevent regulatory delays to groundwater remediation activities, c) reduce time needed for Regional Water Board staff to prepare and the Regional Water Board to adopt WDRs for common remedial activities in the Central Valley Region, d) enhance protection of surface water quality by eliminating some discharges of treated groundwater to surface water, and e) provide a comparable level of water quality protection to individual, site-specific WDRs.
4. This Order regulates the use and application of in-situ biological, chemical, and physical treatments to clean up waste constituents in groundwater. The dischargers regulated by this Order are more appropriately regulated by general WDRs than individual WDRs because the Regional Water Board regulates many sites using this type of process, the cleanup of these type of sites is of high priority and the issuance of individual WDRs is

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

time-consuming without providing additional benefit, and the types of treatment used have similar effects that can reasonably be regulated with general WDRs. This Order does not preclude the adoption of individual WDRs where appropriate.

5. The materials that can be used to remediate groundwater pollution at a site in the Central Valley Region under this Order are limited to those listed in the CONDITIONS OF ELIGIBILITY, listed below. This Order is not intended for use and application of other materials to remediate groundwater pollution or for remediation of waste constituents in groundwater other than VOCs, perchlorate, nitrogen compounds (nitrate, ammonia, etc.), some selected pesticides and semi-volatile organic compounds, and petroleum hydrocarbons.
6. The application of any material to groundwater may result in unintended adverse effects to groundwater quality. To comply with this Order, any potential adverse water quality effects that may occur must be localized, of short-term duration, and may not affect existing or potential beneficial uses of groundwater. Groundwater quality will be monitored before and after addition of any materials to verify both the effectiveness of the remediation and that no long-term adverse effect on beneficial uses of groundwater has occurred.
7. The addition of materials to remediate groundwater may require bench-scale and/or small-scale pilot testing prior to design and implementation of full-scale remediation. The addition of amendments to conduct pilot studies is also covered under this Order.

REGULATORY CONSIDERATIONS

8. *The Water Quality Control Plan, Fourth Edition, for the Sacramento and San Joaquin River Basins, Fourth Edition* (hereafter Basin Plan) designates beneficial uses, establishes water quality objectives (WQOs), contains prohibitions, contains implementation plans and policies for protecting waters of the basin, and incorporates by reference plans and policies adopted by the State Water Resources Control Board (State Water Board). Pursuant to ¶ 13263(a) of the California Water Code (CWC), waste discharge requirements must implement the Basin Plan.
9. The designated beneficial uses of underlying groundwater include, but are not limited to:
 - a. Municipal and domestic water supply (MUN);
 - b. Agricultural water supply (AGR);
 - c. Industrial service supply (IND); and
 - d. Industrial process supply (PRO).
10. The Basin Plan establishes numerical and narrative water quality objectives for surface water and groundwater within the basin, and recognizes that water quality objectives are achieved primarily through the Board's adoption of waste discharge requirements and enforcement orders. Where numerical water quality objectives are listed, these are limits necessary for the reasonable protection of beneficial uses of the water. Where compliance with narrative water quality objectives is required, the Board will, on a case-by-case basis,

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

3

adopt numerical limits in orders, which will implement the narrative objectives to protect beneficial uses of the waters of the state. Finding No. 15 lists those numerical limits for compliance with the narrative objectives for this Order.

11. The Basin Plan identifies numerical water quality objectives for waters designated as municipal supply. These are the maximum contaminant levels (MCLs) specified in the following provisions of Title 22, California Code of Regulations: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Table 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) of Section 64449. The Basin Plan's incorporation of these provisions by reference is prospective, and includes future changes to the incorporated provisions as the changes take effect. The Basin Plan recognizes that the Board may apply limits more stringent than MCLs to ensure that waters do not contain chemical constituents in concentrations that adversely affect beneficial uses.
12. The Basin Plan contains narrative water quality objectives for chemical constituents, tastes and odors, and toxicity. The toxicity objective requires that groundwater be maintained free of toxic substances in concentrations that produce detrimental physiological responses in humans, plants or animals. The chemical constituent objective requires that groundwater shall not contain chemical constituents in concentrations that adversely affect beneficial uses. The tastes and odors objective requires that groundwater shall not contain tastes or odors producing substances in concentrations that cause nuisance or adversely affect beneficial uses.
13. State Water Board Resolution No. 92-49 (hereafter Resolution No. 92-49) requires the Regional Board to require actions for cleanup and abatement of discharges that cause or threaten to cause pollution or nuisance to conform to the provisions of State Water Board Resolution No. 68-16 (hereafter Resolution No. 68-16) and the Basin Plan. Pursuant to Resolution No. 92-49, the Regional Board shall ensure that dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or if background levels of water quality cannot be restored, the best water quality which is reasonable and which complies with the Basin Plan including applicable WQOs.
14. Resolution No. 68-16 requires the Board in regulating discharges to maintain high quality waters of the State until it is demonstrated that any change in quality will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and potential beneficial uses, and will not result in water quality less than that described in plans and policies (e.g., quality that exceeds WQOs). Temporal degradation of groundwater may occur at sites subject to this Order within the defined treatment zone due to the amended groundwater injection. The temporary degradation allowed by this Order is consistent with Resolution No. 68-16 since (1) the purpose is to accelerate and enhance remediation of groundwater pollution and such remediation will benefit the people of the State; (2) the discharge facilitates a project to evaluate the effectiveness of cleanup technology in accord with Resolution No. 92-49; (3) the degradation is limited in scope and

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

4

duration; (4) best practicable treatment and control, including adequate monitoring and hydraulic control to assure protection of water quality, are required; and (5) the discharge will not cause WQOs to be exceeded beyond the treatment zone and it is expected that increases in concentrations above WQOs caused by the treatment will be reduced over time. A slight residual increase in salts may occur at some sites subject to this Order but will be limited to a maximum 10 percent increase over background and less than the WQO listed below in Finding No. 15. See Groundwater Limitation E.3.

15. This Order addresses water quality as it relates to the chemicals being injected, as well as the byproducts and breakdown products produced by the reactions of the injectants, chemicals being treated and geological materials. Cleanup criteria for groundwater are established in an appropriate enforcement document – Record of Decision, Cleanup and Abatement Order, or Remedial Action Plan and are not discussed further as a part of this Order. As discussed above, chemicals are injected to stimulate reduction in concentrations of the target waste constituent and the target waste constituent may undergo a series of transformations to other constituents as it degrades. The injected chemical itself may leave residuals of its components, as well as cause changes in groundwater chemistry that liberate metals found in the formation materials. Background/baseline concentrations of metals and total dissolved solids will be established pursuant to the attached Monitoring and Reporting Program. The applicable WQOs are the narrative toxicity objective, Primary and Secondary Maximum Contaminant Levels, and the narrative taste and odor objective as found in the Basin Plan. Numerical limits in this Order implement those WQOs. The following Table presents the numerical WQOs for potential waste constituents of concern at the site:

Constituent	WQO	Reference
trichloroethene	0.8 µg/L	California Public Health Goal
tetrachloroethene	0.06 µg/L	California Public Health Goal
vinyl chloride	0.05 µg/L	California Public Health Goal
cis 1,2-dichloroethene	6 µg/L	Primary Maximum Contaminant Level
1,2-dichloroethene	10 µg/L	Primary Maximum Contaminant Level
1,2-dichloroethane	0.4 µg/L	California Public Health Goal
1,1-dichloroethene	6 µg/L	Primary Maximum Contaminant Level
1,1-dichloroethane	3 µg/L	California Public Health Goal
1,2,3-trichloropropane	0.0007 µg/L	Draft California Public Health Goal
1,2-dichloropropane	0.5 µg/L	California Public Health Goal
1-chloropropane	280 µg/L	IRIS
propene	28 µg/L	Taste and Odor
iron	300 µg/L	Secondary Maximum Contaminant Level
manganese	50 µg/L	Secondary Maximum Contaminant Level
hexavalent chromium	2 µg/L	Draft PHG
total chromium	50 µg/L	Primary Maximum Contaminant Level
total dissolved solids	450 mg/L	Food and Agricultural Organization
sulfate	250,000 µg/L	Secondary Maximum Contaminant Level
sodium	20,000 µg/L	USEPA Health Advisory
bromate	10 µg/L	Primary Maximum Contaminant Level
chloride	106,000 µg/L	Agricultural Water Quality Goal – Food and Ag

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

5

16. Some amendments used to stimulate degradation of waste constituents in groundwater have a salt component (generally sodium or potassium). Upon completion of the intended degradation process, the salt component remains. The groundwater in the Central Valley is severely degraded by salts and the Regional Board is intent on minimizing the discharge of salts to the groundwater. The use of non salt-containing injectants is preferred, and the Discharger is required to demonstrate that there are no non salt-containing injectant alternatives that will cost-effectively promote the degradation of the target constituent before being allowed to use a salt-containing injectant. See Discharge Specification D.1. Furthermore, the Discharger is required to establish background salt concentrations and monitor the groundwater for changes in salt concentrations during the life of the project. Increases in salt concentrations in ground water are restricted by Groundwater Limitation E.3, below.
17. The action to adopt these Waste Discharge Requirements is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21000, et seq.) (CEQA) because it: (1) authorizes activity that will result in a minor modification to land pursuant to Title 14, California Code of Regulations, Section 15304; (2) consists of an action by a regulatory agency authorizing actions for the protection of the environment pursuant to Title 14, California Code of Regulations, Section 15308; and (3) authorizes minor cleanup actions costing \$1.5 million or less that are taken to prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release of a hazardous waste or substance pursuant to Title 14, California Code of Regulations, Section 15330.
18. The discharge is exempt from the requirements of *Consolidated Regulations for Treatment, Storage, Processing, or Disposal of Solid Waste*, set forth in the Title 27, California Code of Regulations (CCR), section 20005 et seq. (hereafter Title 27), which allows a conditional exemption from some or all of the provisions of Title 27. The exemption, pursuant to Title 27 CCR Section 20090(b), is based on the following:
 - a. The Regional Water Board is issuing waste discharge requirements.
 - b. The discharge is in compliance with the applicable Basin Plan.
 - c. The wastewater does not need to be managed according to Title 22CCR, Division 4.5 and Chapter 11 as a hazardous waste.

Section 20090(d) allows exemption for a project to cleanup a condition of pollution that resulted from an unauthorized discharge of waste based on the following:

- d. The application of amendments to groundwater is at the direction of the Regional Water Board to cleanup and abates conditions of pollution or nuisance resulting from the unauthorized discharge of waste.
- e. Wastes removed from the immediate place of release must be discharged according to the Title 27 regulations; and
- f. The cleanup actions intended to contain wastes at the place of release shall implement the Title 27 regulations to the extent feasible.

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

19. Section 13267(b) of the California Water Code provides that:

"In conducting an investigation specified in subdivision (a), the Regional Board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste outside of its region that could affect the quality of the waters of the state within its region shall furnish under penalty of perjury, technical or monitoring program reports which the Regional Board requires. The burden, including costs of these reports, shall bear a reasonable relationship to the need for the reports and the benefits to be obtained from the reports. In requiring these reports, the Regional Board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports."

The technical reports required by this Order and the attached Monitoring and Reporting Program are necessary to assure compliance with this Order. The Discharger operates the facility that discharges the waste subject to this Order.

20. The California Department of Water Resources sets standards for the construction and destruction of groundwater wells, as described in *California Well Standards Bulletin No. 74-90* (June 1991) and *Water Well Standards: State of California Bulletin No. 94-81* (December 1981). These standards, and any more stringent standards implemented by the Regional Water Board or adopted by the local county where the site is located pursuant to California Water Code Section 13801 apply to all monitoring and injection wells.
21. Section 3020(b)(2) of the Resource Conservation and Recovery Act (RCRA) states that prior to injection into or above an underground source of drinking water, contaminated groundwater shall be "...treated to substantially reduce hazardous constituents prior to such injection." In a letter dated 10 December 1999, the United States Environmental Protection Agency, Office of Solid Waste and Emergency Response (OSWER) states, "If extracted groundwater is amended at the surface (i.e., "treated") before reinjection, and the subsequent in-situ bioremediation achieves a substantial reduction of hazardous constituents the remedy would satisfy Section 3020(b)(2)." The injection of groundwater within the treatment zone in compliance with this Order, with or without the treatment for the constituents of concern, complies with Section 3020(2)(b) of RCRA.
22. Section 13304.1(b) of the California Water Code requires that the Regional Board shall consult with the affected groundwater management entity, if any, affected public water systems, and the State Department of Public Health prior to setting applicable water quality standards to be achieved at groundwater cleanup sites that are associated with an aquifer that is used as a drinking water source. Prior to issuing a Notice of Applicability under this Order for a specified project, the Regional Board will consult with the appropriate interested agencies.

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

7

23. Section 13307.5 of the California Water Code requires specific public participation actions if the site cleanup is being undertaken pursuant to a cleanup and abatement order. When applying this Order to sites subject to a cleanup and abatement order, the required public participation will be adhered to.

Other

24. Pursuant to California Water Code Section 13263(g), discharge is a privilege, not a right, and adoption of this Order does not create a vested right to continue the discharge.
25. All the above and the supplemental data and information and details in the attached Information Sheet, which is incorporated by reference herein, were considered in establishing the following conditions of discharge.
26. The Discharger and interested agencies and persons were notified of the intent to prescribe waste discharge requirements for this discharge and provided with an opportunity for a public hearing and an opportunity to submit written comments.
27. In a public meeting, all comments pertaining to this Order were heard and considered.

IT IS HEREBY ORDERED that, pursuant to Sections 13263 and 13267 of the California Water Code, Dischargers, in order to meet the provisions contained in Division 7 of the California Water Code, and regulations and guidelines adopted thereunder, shall comply with the following:

A. CONDITIONS OF ELIGIBILITY

1. A discharger may seek coverage under this Order to:
 - a. Add specific amendments directly to groundwater or indirectly through the soil column for the purpose of facilitating in situ remediation of waste constituents. The Discharger must demonstrate the effectiveness of the selected amendment(s), and demonstrate control of side reactions and breakdown products under site conditions.
2. To be covered under this Order, a discharger must provide the following:
 - a. A Notice of Intent (Attachment A), including additional information as required in Attachment B (Report of Waste Discharge);
 - b. A Regional Board approved Work Plan, Work Plan Addendums (if applicable), and/or a Remedial Action Plan or Cleanup Plan which includes application of an amendment that qualifies for coverage under this Order (The approval for the

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

8

Work Plan or Remedial Action Plan needs to be dated within 12 months of the date of the Notice of Intent);

- c. A proposed Monitoring and Reporting Program, based on Attachment C, incorporated herein by reference; and
 - d. The first annual fee in accordance with the current version of the California Code of Regulation, Title 23, Division 7, Chapter 9, Waste Discharge Report and Requirements Article 1 fees for a discharge. The check or money order shall be made payable to the "State Water Resources Control Board".
 - e. A Contingency Plan to be implemented to correct unacceptable water quality effects.
3. This Order covers the following actions:
- a. Pilot studies of limited extent and duration:
 - i. When the amendments have previously been demonstrated (previous pilot tests or full-scale operations) to achieve the desired results and side reactions, byproducts, breakdown products, and residuals are understood.
 - ii. When processes to remove byproducts, breakdown products, and residuals are identified and discussed in the Remedial Action Work Plan or Report of Waste Discharge.
 - b. Full-scale applications:
 - i. When it has been demonstrated in a pilot study, or full-scale application at this site or a similar site, that the desired results can be achieved and side reactions, breakdown products, and residuals do not result in long-term adverse water quality effects.
4. Coverage under this Order applies to the following groups of amendments, except as specifically excluded in A5 below, provided the conditions in A1, A2, and A3 are satisfied:
- a. Amendments that create reducing conditions (i.e., amendments that provide carbon, energy, electrons and/or macronutrients). Examples include:
 - i. Zero valent iron
 - ii. Easily degradable carbon sources such as glucose, acetate, citric acid, acetic acid, ethanol, methanol and others
 - iii. Slowly degradable carbon sources such as edible oils, poly-lactate, and other hydrogen release compounds
 - iv. Polysulfides
 - v. Macro nutrients such as nitrate, phosphate, and potassium

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

9

- vi. Microorganisms cultured on site materials
 - b. Amendments that create oxidizing conditions (i.e., amendments that provide oxygen or otherwise gain electrons). Examples include:
 - i. Air
 - ii. Oxygen
 - iii. Ozone
 - iv. Potassium or sodium permanganate
 - v. Oxygen release compounds
 - vi. Hydrogen peroxide
 - c. Multiple amendments (includes application of reducing agents or oxidizing agents or both applied concurrently or over time as proposed in an approved Work Plan and the Notice of Intent). Examples include:
 - i. Establishing a reducing zone immediately downgradient of an oxidizing zone to reduce hexavalent chromium that may be produced under oxidizing conditions
 - ii. Providing a slowly degradable carbon source along with polysulfides to precipitate sulfates as metal sulfides.
 - d. Tracer compounds as discussed in Attachment A (Notice of Intent/Report of Waste Discharge).
 - e. Biofouling control agents such as chlorine dioxide, chlorine and bleach.
5. Amendments specifically excluded from coverage under this Order:
- a. Amendments that may cause violent exothermic reactions.

B. NOTIFICATION OF COVERAGE

Project coverage under this Order shall not take effect until the Executive Officer notifies the Discharger in writing, by issuance of a Notice of Applicability which shall be a part of this Order, that coverage has been issued. The Executive Officer will not issue notification of project coverage under this Order prior to providing notice and a 30-day public comment period on the proposed issuance of coverage. Notification of project coverage under this Order shall not be issued if the Executive Officer finds that there may be significant effects on water quality, or finds that significant public controversy has arisen or will likely arise from the issuance of project coverage by this Order and that individual Waste Discharge Requirements should be considered at a regularly scheduled Regional Water Board meeting.

C. DISCHARGE PROHIBITIONS

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

1. The discharge of any amendment or other materials not specifically regulated by this Order is prohibited. These amendments and materials are those listed in the approved Work Plan required in A.2.b and the Notice of Applicability, as listed above.
2. Creation of a pollution, contamination, or nuisance, as defined by Section 13050 of the California Water Code (CWC), is prohibited.
3. The discharge of amendments or wastes to surface water or surface water drainage courses is prohibited.
4. The discharge of amendments or wastes to land or groundwater in areas other than that proposed for remediation is prohibited.
5. The discharge of amendments to property that is not under the control of the Discharger is prohibited. The "area under the control" of the Discharger is considered to be at the horizontal borders of the waste plume and owned by the Discharger and/or where the Discharger holds an agreement with the property owner for purposes of investigation and remediation.
6. The migration of any byproducts produced as part of the treatment process beyond the boundaries of the property owned or controlled by the discharger or to surface waters is prohibited.

D. DISCHARGE SPECIFICATIONS

1. The Discharger shall not inject any amendments into the aquifer prior to receiving the Notice of Applicability nor prior to the construction of all necessary monitor wells listed in the Monitoring and Reporting Program.
2. The groundwater shall not be amended with materials other than those approved in the Notice of Applicability.
3. The Discharger will minimize the amount of amendments injected to the extent practicable.

E. GROUNDWATER LIMITATIONS

1. The discharge shall not cause the pH of the groundwater at the compliance points, downgradient and outside the treatment zone, to shift outside the range of 6.5 to 8.5.
2. The release, injection, discharge or addition of constituents from a remediation system shall not cause the groundwater at the compliance wells listed in Table 1 of the Monitoring and Reporting Program attached to the Notice of Applicability, and any revisions thereto, to contain concentrations of chemical constituents, including the

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

11

amendments and by-products of the in-situ treatment process, in amounts that exceed the Water Quality Objectives listed in Finding No. 15.

3. The release, injection, discharge or addition of constituents from a remediation system shall not cause the groundwater at the compliance wells listed in Table 1 of the Monitoring and Reporting Program attached to the Notice of Applicability, and any revisions thereto, to contain concentrations of metals, total dissolved solids, or electrical conductivity that are more than 20% greater than their respective background concentrations, as established by the Monitoring and Reporting Program attached to the Notice of Applicability, and any revisions thereto.
4. The release, injection, discharge or addition of constituents from a remediation system shall not cause the groundwater to contain taste or odor producing substances that cause nuisance or adversely affect beneficial uses at the compliance monitor points designated in Table 1 of the Monitoring and Reporting Program attached to the Notice of Applicability, and any revisions thereto.

F. PROVISIONS

1. The Discharger shall comply with all applicable Standard Provisions and Reporting Requirements for Waste Discharge Requirements, dated 1 March 1991, which are attached hereto and by reference a part of this Order. This attachment and its individual paragraphs are commonly referenced as Standard Provisions.
2. The Discharger shall comply with the Monitoring and Reporting Program, attached to the Notice of Applicability, and any revisions thereto, as ordered by the Executive Officer.
3. The Discharger may be required to submit technical reports pursuant to California Water Code Section 13267 as directed by the Executive Officer. The technical reports required by this Order are necessary to assure compliance with this Order.
4. All technical reports required herein that involve planning, investigation, evaluation, or design or other work requiring interpretation or proper application of engineering or geologic sciences, shall be prepared by, or under the direction of, persons registered to practice in California pursuant to California Business and Professions Code, sections 6735, 7835 and 7835.1. To demonstrate compliance with Title 16, CCR, Sections 415 and 3065, all technical reports must contain a statement of the qualifications of the responsible registered professional(s). As required by these laws, completed technical reports must bear the signature(s) and seal(s) of the registered professional(s) in a manner such that all work can be clearly attributed to the professional responsible for the work.
5. A copy of this Order shall be maintained at the project site and be available at all times to operating personnel.

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

12

6. Provisions of this Order are severable. If any provision of these requirements is found invalid, the remainder of this Order shall not be affected.
7. The Discharger shall maintain in good working order and operate as efficiently as possible any facility or control system installed by the discharger to achieve compliance with this Order.
8. In the event of a violation of the order, or any material change in the character, location, or volume of the discharge, or if the Discharger is unable to comply with any of the conditions of this Order due to:
 - a. breakdown of any facility or control system or monitoring equipment installed by the Discharger to achieve compliance with this Order;
 - b. migration or application of amendments, pollutants or byproducts outside the specified treatment area;
 - c. accidents caused by human error or negligence; or
 - d. other causes such as acts of nature;

the Discharger shall notify the Regional Water Board by telephone within 24-hours after he or his agents have knowledge of the incident and confirm this notification in writing within two weeks of the telephone notification. The written notification shall include pertinent information explaining reasons for the noncompliance and shall indicate the steps taken to correct the problem and the dates thereof, and the steps being taken to prevent the problem from recurring. The reporting of migration or application of amendments, waste constituents or byproducts outside the specified treatment area shall include an assessment of and schedule for implementation of the contingency plans required in the Notice of Applicability.

9. The Discharger shall report within 48-hours to the Regional Water Board any violation of this Order, and any material change in the character, location, or volume of the discharge.
10. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the discharger, the discharger shall notify the succeeding owner or operator of the following items by letter, in advance of the transfer of ownership or control, a copy of the notice must be forwarded to the Regional Water Board:
 - a. existence of this Order; and
 - b. the status of the discharger's annual fee account
11. This Order does not convey any property rights of any sort or any exclusive privileges. The requirements prescribed herein do not authorize the commission of any act

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

13

causing injury to persons or property, nor protect the discharger from his liability under Federal, State, or Local laws, nor create a vested right for the discharger to continue the waste discharge.

12. Chemical, bacteriological, and bioassay analyses must be conducted at a laboratory certified for such analyses by the State Department of Public Health.
13. All reports, Notice of Intent, or other documents required by this Order, and other information requested by the Regional Board shall be signed by a person described below or by a duly authorized representative of that person.
 - a. for a corporation: by a responsible corporate officer such as: (a) a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function; (b) any other person who performs similar policy or decision making functions for the corporation; or (c) the manager of one or more manufacturing, production, or operating facilities if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
 - b. Reports required by this Order, other information requested by the Regional Water Board, and Notices of Intent may be signed by a duly authorized representative provided:
 - i. the authorization is made in writing by a person described in paragraph (a) of this provision;
 - ii. the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company; and
 - iii. the written authorization is submitted to the Regional Water Board prior to or together with any reports, information, or applications signed by the authorized representative.
 - c. Any person signing a document under paragraph (a) or (b) of this provision shall make the following certification: "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted, is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine

WASTE DISCHARGE REQUIREMENTS GENERAL ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES IMPACTED BY VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS, HEXAVALENT CHROMIUM AND/OR PETROLEUM HYDROCARBONS

14

and imprisonment for knowing violations."

14. The Discharger shall permit authorized staff of the Regional Water Board:
 - a. entry to the project site covered by this Order or in which any required records are kept;
 - b. access to copy any records required to be kept under terms and conditions of this Order;
 - c. inspection of monitoring equipment or records; and
 - d. sampling of any discharge.
15. The Regional Water Board may review this Order periodically and may revise requirements when necessary. In addition, the discharger shall file a report of waste discharge with the Executive Officer at least 120 days before making any material change or proposed change in the character, location, or volume of the discharge.
16. This Order is in effect until terminated by the Executive Officer. Project coverage under this Order may be terminated, by the Executive Officer at any time upon giving reasonable notice to the discharger.

I, Pamela C. Creedon, Executive Officer, do hereby certify that the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, Central Valley Region, on 11 September 2008.

original signed by:
PAMELA C. CREEDON, Executive Officer

12/06/07: AMM-AT-MLP

ATTACHMENT A

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

NOTICE OF INTENT

TO COMPLY WITH THE TERMS OF
GENERAL WASTE DISCHARGE REQUIREMENTS ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

1. RESPONSIBLE PARTY INFORMATION

Owner Name:				
Mailing Address:				
City/Locale:	County:	State:	Zip:	Telephone Number:
Operator Name (if different than above):				
Mailing Address:	County:	State:	Zip:	Telephone Number:
Contact Person:	Title:		Telephone Number:	
Owner Type: (check one) Individual <input type="checkbox"/> Corporation <input type="checkbox"/> Partnership <input type="checkbox"/> Other:				

2. TREATMENT SITE INFORMATION

Site Name:				
Physical Address:				
City/Locale:	County:	State:	Zip:	Telephone Number:

3. LOCATION OF FACILITY

Assessor's Parcel #:	Closest Surface Water: (e.g. Sacramento River)
Township/Range/Section: T ___ R ___ S ___ B&M	

4. REASON FOR FILING

<input type="checkbox"/> New Pilot Study <input type="checkbox"/> New Full-Scale Treatment <input type="checkbox"/> Update Plot Study <input type="checkbox"/> Update Full-Scale Treatment	<input type="checkbox"/> Changes in Ownership/Operator <input type="checkbox"/> Other
---	--

5. LOCAL PERMITS

Has an agency issued permits or other entitlements (e.g., conditional use permit, building permit, hazardous materials storage permit, air permit, well permit) for the site? <input type="checkbox"/> Yes <input type="checkbox"/> No
For each permit or entitlement, list the type, issuing agency, and date of issuance:

Notice of Intent for General WDRs Order No. R5-2008-0149

- 2 -

IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC COMPOUNDS,
NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

6. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Has a CEQA determination been made by an agency? <input type="checkbox"/> Yes <input type="checkbox"/> No	Name of agency:
Type of Determination:	Date of Determination:
If the CEQA determination was made after the date of adoption of this General WDR, then include a copy of the CEQA determination with this NOI.	

7. PROCESS

<input type="checkbox"/> Single-Injection Points <input type="checkbox"/> Continuous Injection <input type="checkbox"/> Redcirculation System		
Amendments to be added:	Volumes of Amendments per Month:	Storage on Site? <input type="checkbox"/> Yes <input type="checkbox"/> No
Pollutants to be treated:	Rates of amendment additions:	Max rate of amendment addition:
Extraction and Injection Rates (give units)		Treatment Methods and flows (give units):
Average:	Maximum:	Average: Maximum:

8. WASTES GENERATED

Check All That Apply:	
<input type="checkbox"/> Treatment Wastewater	<input type="checkbox"/> Domestic Wastewater (separate system)
<input type="checkbox"/> Stormwater	<input type="checkbox"/> Solid waste - Type _____

9. AMENDMENT STORAGE

Describe the type(s) of storage vessels, including capacity of each, that will be used to store amendments:
How will liquid be stored and monitored to prevent spillage?

10. CERTIFICATION

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print Name: _____ Title: _____

Signature: _____ Date: _____

ATTACHMENT A

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD CENTRAL VALLEY REGION

INSTRUCTIONS

FOR COMPLETING THE NOTICE OF INTENT TO COMPLY WITH THE TERMS OF GENERAL WASTE DISCHARGE REQUIREMENTS ORDER NO. R5-2008-0149 FOR IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES, SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

The Notice of Intent is to be submitted by responsible parties that elect to obtain coverage under the above General Order. If you have any questions regarding the completion of any part of the following form, please contact your Regional Board representative, as described on page 4. Much of the information needed to complete this form may be available from County Use Permit engineering reports or county records. Any additional information supplied, as detailed in Attachment B, should be included on attached sheets and list all attachments with the titles and dates in the spaces provided.

1. RESPONSIBLE PARTY INFORMATION

You must provide the information listed below for ALL persons or entities that hold legal interests associated with the facility or real property on which it is located. These may include, but are not limited to, owners, leaseholders, lessees, and operators.

Under *Owner Name/Address*, include the legal name of the business entities and/or persons who own the facility undergoing remedial activities, the owner's mailing address, and phone number.

Under *Operator Name*, include the name of the business entities or persons who actually operate the facility only if different than the owner.

Under *Mailing Address*, include the mailing address where legal notices may be received by the operator if it is different from the physical facility address. You may specify another contact person at the mailing address if desired.

Check the appropriate Owner type. Both the Owner and the Operator will be named in the Notice of Applicability and will receive legal notices and invoices at these addresses.

2. TREATMENT SITE INFORMATION:

Provide the Facility name, the physical address of the treatment location, the facility contact person (preferably a responsible employee with offices at the facility), and phone number at the facility. Do not use a P.O. Box number in this section. If there is no street address, use closest street and nearest cross street.

3. LOCATION OF FACILITY

Enter the Assessor's Parcel Number(s) (APN). This number is located on the property tax bill and can also be obtained from the County Assessor's Office. Indicate the APN for both the facility and any land discharge areas owned by the Discharger. Specify the closest surface water body in the vicinity of the facility, such as a creek, canal, or river.

ATTACHMENT A

- 2 -

INSTRUCTIONS FOR COMPLETING THE NOTICE OF INTENT TO COMPLY WITH
GENERAL ORDER NO. R5-2008-0149 FOR IN-SITU GROUNDWATER REMEDIATION
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC COMPOUNDS, NITROGEN
COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

4. REASON FOR FILING

Check the appropriate box or boxes.

5. LOCAL PERMITS

Construction and operation of some types of facilities usually involves permits or entitlements from a local agency, such as a City or County. These permits or entitlements may include discretionary or ministerial permits such as conditional use permits, hazardous waste storage permits, air permits, well permits, and building permits. Documents and information should be available from the issuing agency, in most cases the City/County planning department. For each permit or entitlement, identify the issuing agency, the date of issuance, and provide a copy of associated documentation.

6. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Compliance with the California Environmental Quality Act (CEQA) is required prior to enrollment under the General WDRs. The CEQA lead agency must either determine that your project is exempt from CEQA, or must prepare an environmental document (either an Environmental Impact Report, Mitigated Negative Declaration, or Negative Declaration).

Has a public agency made a CEQA determination for the facility? If YES, give the name, date, and type of determination (This could be a Notice of Exemption, Notice of Determination, Negative Declaration, etc.). Enclose a copy of the CEQA documentation. If NO, fill in the expected type and date of completion. For the date of completion, list the date that the CEQA documentation will be completed. If not known, write "Unknown".

7. PROCESS

Provide summary information here. Much of the descriptive and technical information will be submitted to comply with the information needs specified in Attachment B.

8. WASTES GENERATED

Check all types of wastes that exist at your facility.

9. AMENDMENT STORAGE

Provide the requested information, and attach additional sheets as necessary. An above ground or underground tank may be used to contain the amendments; in either case, the tank must be constructed of materials suitable for the intended use.

10. CERTIFICATION

Certification by the operator of the facility is required. The appropriate person must sign the application form. Acceptable signatures are:

- a. For a corporation, a principal executive officer of at least the level of senior vice-president;
- b. For a partnership or individual (sole proprietorship), a general partner or the proprietor;

ATTACHMENT A

- 3 -

INSTRUCTIONS FOR COMPLETING THE NOTICE OF INTENT TO COMPLY WITH
GENERAL ORDER NO. R5-2008-0149 FOR IN-SITU GROUNDWATER REMEDIATION
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC COMPOUNDS, NITROGEN
COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

11. ADDITIONAL INFORMATION

Attach the required information detailed in Attachments A and B to the NOI.

12. SUBMITTAL

Submit the complete NOI, supplemental information, and the first annual fee in the form a check payable to *State Water Resources Control Board* to the appropriate Regional Board office. The fee shall be that required by the current version of the California Code of Regulation, Title 23, Division 7, Chapter 9, Waste Discharge Report and Requirements, Article 1, fees for discharge for a Threat to Water Quality and Complexity ranking of 3B.

For projects within Alameda, Alpine, Amador, Calaveras, Colusa, Contra Costa, El Dorado, Glenn Lake, Napa, Nevada, Placer, Sacramento, San Joaquin, Sierra, Solano, Sutter, Yolo, and Yuba Counties, submit the NOI and filing fee to:

Regional Water Quality Control Board, Central Valley Region
3443 Routier Road, Suite A
Sacramento, CA 95827
(916) 454-3281
Attention: Alexander MacDonald

For projects within Fresno, Kern, Kings, Madera, Mariposa, Merced, Stanislaus, Tulare and Tuolumne Counties, submit the NOI and filing fee to:

Regional Water Quality Control Board, Central Valley Region
1685 "E" Street
Fresno, CA 93706
(559) 445-5116
Attention:

For projects within Butte, Lassen, Modoc, Plumas, Shasta, and Tehama Counties, submit the NOI and filing fee to:

Regional Water Quality Control Board, Central Valley Region
415 Knollcrest Drive, Suite 100
Redding, CA 96002
(530) 224-4845
Attention:

Attachment B
Notice of Intent Additional Information Requirements

- A Final Approved Work Plan and CEQA document for the project. Any of the information required below that is contained in the work plan need not be reproduced separately from the work plan.
- B Final Approved Remedial Action Plan. If a Remedial Action Plan has been approved, a copy of the Remedial Action Plan should also be provided.
- C Location:
 - i) USGS Quad Sheet delineating location.
 - ii) Another figure showing a closer view of the site.
 - iii) A description of the remediation area and area surrounding the remediation area.
- D Bench Scale/Pilot Scale Testing:
 - i) Results from bench scale or pilot-scale testing that demonstrates that the proposed project is likely to be successful at the site. If the data provided is from a different project location, the provided information needs to support that the tested site is substantially similar to the proposed project site in regards to soil properties and makeup.
- E Geology/Hydrogeology:
 - i) A description of the geology/hydrogeology of the site and surrounding area within ¼ mile of the site.
 - ii) Geologic cross-sections through the site, both perpendicular and parallel to the groundwater flow direction.
 - iii) Table of monitor wells in the vicinity including as-built information.
- F Groundwater Information:
 - i) Narrative description of the occurrence and quality of groundwater at the site, including upgradient and downgradient conditions
 - ii) A figure depicting groundwater monitor wells/piezometers and water supply wells
 - iii) Figures showing groundwater potentiometric surface maps for each layer of interest.
 - iv) Figure showing water supply wells within 1-mile of the project location, along with any available information regarding construction, use and pumping rates.

G Water Quality Information:

- i) Tables of water quality data for each monitor well within the area of the testing. Wells segregated into monitor zones, and upgradient, downgradient and within the plume wells. The data should include detection and reporting levels for the analyses listed.
- ii) Water quality data should include VOCs, general minerals, metals (need to include iron, manganese, total chromium, hexavalent chromium, . . .), sulfate, nitrate, ammonia, dissolved oxygen, oxidation/reduction potential, chemical oxygen demand, total dissolved solids, electrical conductivity, temperature
- iii) Figures depicting the groundwater contaminant plume configurations for each of the monitor zones.
- iv) Tables presenting background concentrations of COCs, injectant components and potential breakdown products.

H Project Proposal:

- i) Proposed injection points
- ii) Injectant(s) to be used for remediation and for biofouling control
- iii) Analysis of the injectants – VOCs, semi-VOCs, metals, general minerals, pH, TDS. . .
- iv) Potential breakdown products of COCs and injectants. Estimated concentrations of the injectants and breakdown products remaining at the conclusion of the project. The estimated concentrations need to be compared to background concentrations of the pollutants.
- v) Proposed injectant rates and concentrations.
- vi) Proposed tracer compounds, application concentration rates, and concentrations of tracer within treatment zone for conducting tracer tests
- vii) Delineation of treatment zone – including figure
- viii) Delineation of transition zone – including figure
- ix) Proposed monitoring program – frequency, methods, quantitation and detection limits – use Attachment C as template.
- x) Treatment system, if any, description and proposed operation
- xi) List of proposed wells, and figure delineating the locations of the wells, for monitoring upgradient and downgradient groundwater quality and groundwater elevations. Wells should be designated for the treatment zone, transition area within treatment zone and compliance wells at the treatment zone downgradient boundary.
- xii) Contingency Plan – Plan for corrective actions if violations are found at the points of compliance.

I List of Interested Parties

J Draft Fact Sheet

ATTACHMENT C

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION

MONITORING AND REPORTING PROGRAM NO. R5-200X-XXXX

FOR

IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

NOTE: THIS MONITORING AND REPORTING PROGRAM SHALL BE CUSTOMIZED TO FIT THE SITE-SPECIFIC NEEDS OF THE PROJECT. CONSTITUENTS TO BE SAMPLED, SAMPLING FREQUENCY AND REPORTING FREQUENCY NEED TO BE SPECIFIED FOR THE PROJECT. THE TABLES PROVIDE TEMPLATES AND LIKELY CONSTITUENT LISTS THAT NEED TO BE MODIFIED TO MEET THE SITE-SPECIFIC NEEDS.

This Monitoring and Reporting Program (MRP) describes requirements for monitoring a groundwater extraction and treatment system. This MRP is issued pursuant to Water Code Section 13267. The Discharger shall not implement any changes to this MRP unless and until a revised MRP is issued by the Executive Officer. As appropriate, Regional Board staff shall approve specific sample station locations prior to implementation of sampling activities.

All samples should be representative of the volume and nature of the discharge or matrix of material sampled. The time, date, and location of each grab sample shall be recorded on the sample chain of custody form.

GROUNDWATER MONITORING

As shown on Figure x, there are xx monitor wells, xx extraction wells, and xx injection wells/trenches associated with this site. The groundwater monitoring program for these wells and any treatment system wells installed subsequent to the issuance of this MRP, shall follow the schedule below. Monitor wells with free phase petroleum product or visible sheen shall be monitored, at a minimum, for product thickness and depth to water. The volume of extracted groundwater, if applicable, shall also be provided in quarterly monitoring reports. Sample collection and analysis shall follow standard EPA protocol.

The monitor wells, extraction wells and/or injection wells shall be sampled according to the schedule in Table 1 and the samples analyzed by the methods in Table 2, as follows:

Table 1: Sampling Frequency and Constituent Suite

Well Number ¹	Frequency ²	Constituent Suite(s) ³	Monitoring Objective
			Compliance ⁴
			Treatment Zone ⁵
			Transition Zone ⁶
			Background ⁷

MONITORING AND REPORTING PROGRAM ORDER NO. R5-200X-XXXX
DISCHARGER NAME
COUNTY

2

- ¹ Well numbers as shown on Figure X.
- ² i.e., weekly, monthly, quarterly, annually, other.
- ³ Constituent suite components listed in Table 2.
- ⁴ Wells used to determine compliance with water groundwater limitations.
- ⁵ Wells sampled to evaluate in-situ bioremediation progress inside the treatment zone.
- ⁶ Wells sampled to evaluate migration of pollutants within the treatment zone.
- ⁷ Wells used to develop background concentrations.

NOTE: ADD/DELETE CONSTITUENTS AND METHODS AS NEEDED in Tables 2 through 5
NOTE: GROUP CONSITUENTS INTO SUITES BASED ON FREQUENCY TO BE SAMPLED.
AS AN EXAMPLE, PLACE ALL CONSTITUENTS THAT WILL BE SAMPLED FOR ON A
MONTHLY BASIS IN SUITE A. TABLE 2 SHOWN BELOW PROVIDES THE GENERAL
LIST OF CONSTITUENTS THAT ARE MOST LIKELY TO BE SAMPLED FOR AT AN
INSITU REMEDIATION SITE

Table 2: Analytical Methods

Constituent	Method ¹	Maximum Practical Quantitation Limit (µg/L) ²
Suite A		
Volatile Organic Compounds	EPA 8020 or 8260B	0.5
Sodium		
Potassium		
Suite B		
Volatile Organic Acids	EPA 6500	1,000
Orthophosphate	Hach Method 8131	30
Suite C		
Ethane	Modified EPA 602	0.1
Ethene	Modified EPA 602	0.1
Methane	Modified EPA 602	0.1
Total Dissolved Solids	EPA 160.1	10,000
Total Organic Carbon	EPA 415	300
Chloride	EPA 6500	300
Nitrate	EPA 6500	300
Sulfate	EPA 6500	200
Sulfide	Hach Method 8131	30
Suite D		
Iron, Total and Dissolved	EPA 200.7	100
Ferrous and Ferric Iron	EPA 200, 6020 or SM3000	100
Hexavalent Chromium		
Phosphorous	EPA 200.7, 365	1,000
Metals, Total and Dissolved ³	EPA 200.7, 200.8	Various

- ¹ Or an equivalent EPA Method that achieves the maximum Practical Quantitation Limit.
- ² All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported as an estimated value.

MONITORING AND REPORTING PROGRAM ORDER NO. R5-200X-XXXX
 DISCHARGER NAME
 COUNTY

3

- ³ Metals include barium cadmium, calcium, total chromium, copper, lead, magnesium, manganese, mercury, molybdenum, nickel and silica.

FIELD SAMPLING

In addition to the above sampling and analysis, field sampling and analysis shall be conducted each time a monitor well or extraction well is sampled. The sampling and analysis of field parameters shall be as specified in Table 3.

Table 3: Field Sampling Requirements

Parameters	Units	Type of Sample
Groundwater Elevation	Feet, Mean Sea Level	Measurement
Oxidation-Reduction Potential	Millivolts	Grab
Electrical Conductivity	uhmos/cm	Grab
Dissolved Oxygen	mg/L	Grab
pH	pH Units (to 0.1 units)	Grab

Field test instruments (such as those used to test pH and dissolved oxygen) may be used provided that:

1. The operator is trained in proper use and maintenance of the instruments;
2. The instruments are calibrated prior to each monitoring event;
3. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Field calibration reports are submitted as described in item (b) of the "Reporting" section of this MRP.

DISCHARGE MONITORING

The Discharger shall monitor daily the discharge of water and amendments that are injected into the groundwater according to the requirements specified in Table 4. Each amendment addition shall be recorded individually, along with information regarding the time period over which the amendment was injected into the aquifer.

Table 4: Discharge Monitoring Requirements

Parameters	Units	Type of Sample
Injected Volume	gallons per day	Meter
Amendment(s) Added	kilograms per day	Measured
Biocide Added	kilograms per day	Measured

MONITORING AND REPORTING PROGRAM ORDER NO. R5-200X-XXXX
 DISCHARGER NAME
 COUNTY

4

AMENDMENT ANALYSIS

Prior to use, amendments shall be analyzed for the constituents listed in Table 5. The analysis should be done on the pure amendment and on a mixture of the amendment and deionized water at the estimated concentration that would be injected during the pilot project.

Table 5: Amendment Analytical Requirements

Constituent	Method ¹	Maximum Practical Quantitation Limit (µg/L) ²
Volatile Organic Compounds	EPA 8020 or 8260B	0.5
General Minerals ³		
Metals, Total and Dissolved ⁴	EPA 200.7, 200.8	Various
Semi-Volatile Organic Compounds	EPA Method 8270	5.0
Total Dissolved Solids	EPA 160.1	10,000
pH	meter	NA
Electrical Conductivity	meter	NA

¹ Or an equivalent EPA Method that achieves the maximum Practical Quantitation Limit.

² All concentrations between the Method Detection Limit and the Practical Quantitation Limit shall be reported, and reported as an estimated value.

³ Alkalinity, bicarbonate, potassium, chloride, sulfate, total hardness, nitrate, nitrite, ammonia.

⁴ Metals include arsenic, barium, cadmium, calcium, total chromium, copper, iron, lead, manganese, magnesium, mercury, molybdenum, nickel, selenium and silica.

ESTABLISHMENT OF BACKGROUND CONCENTRATION VALUES

The Discharger shall develop background values for concentrations of dissolved iron, dissolved manganese, metal xxx, total dissolved solids and electrical conductivity in groundwater following the procedures found in CCR Section 20415(e)(10). The Discharger shall submit a proposal to develop the background concentrations by XX XXXXX XXXX.

REPORTING

NOTE: CUSTOMIZE THE REPORTING FREQUENCY WITH THAT NEEDED. QUARTERLY REPORTS ARE RECOMMENDED AND THIS SECTION IS DEVELOPED AROUND THAT CONCEPT

When reporting the data, the Discharger shall arrange the information in tabular form so that the date, the constituents, and the concentrations are readily discernible. The data shall be summarized in such a manner as to illustrate clearly the compliance with this Order. In addition, the Discharger shall notify the Regional Board within 48 hours of any unscheduled shutdown of any soil vapor and/or groundwater extraction system. The results of any monitoring done more frequently than required at the locations specified in the Monitoring and Reporting Program shall also be reported to the Regional Board.

As required by the California Business and Professions Code Sections 6735, 7835, and 7835.1, all reports shall be prepared by a registered professional or their subordinate and signed by the registered professional.

MONITORING AND REPORTING PROGRAM ORDER NO. R5-200X-XXXX
 DISCHARGER NAME
 COUNTY

5

The Discharger shall submit quarterly electronic data reports, which conform to the requirements of the California Code of Regulations, Title 23, Division 3, Chapter 30. The quarterly reports shall be submitted electronically over the internet to the Geotracker database system by the 1st day of the second month following the end of each calendar quarter by 1 February, 1 May, 1 August, and 1 November until such time as the Executive Officer determines that the reports are no longer necessary.

Hard copies of quarterly reports shall be submitted to the Regional Board by the 1st day of the second month following the end of each calendar quarter (i.e., by 1 February, 1 May, 1 August, and 1 November). Each quarterly report shall include the following minimum information:

- (a) a description and discussion of the groundwater sampling event and results, including trends in the concentrations of pollutants and groundwater elevations in the wells, how and when samples were collected, and whether the pollutant plume(s) is delineated;
- (b) field logs that contain, at a minimum, water quality parameters measured before, during, and after purging, method of purging, depth of water, volume of water purged, etc.;
- (c) groundwater contour maps for all groundwater zones, if applicable;
- (d) pollutant concentration maps for all groundwater zones; if applicable;
- (e) a table showing well construction details such as well number, groundwater zone being monitored, coordinates (longitude and latitude), ground surface elevation, reference elevation, elevation of screen, elevation of bentonite, elevation of filter pack, and elevation of well bottom;
- (f) a table showing historical lateral and vertical (if applicable) flow directions and gradients;
- (g) cumulative data tables containing the water quality analytical results and depth to groundwater;
- (h) a copy of the laboratory analytical data report, which may be submitted in an electronic format;
- (i) the status of any ongoing remediation, including an estimate of the cumulative mass of pollutant removed from the subsurface, system operating time, the effectiveness of the remediation system, and any field notes pertaining to the operation and maintenance of the system; and
- (j) if applicable, the reasons for and duration of all interruptions in the operation of any remediation system, and actions planned or taken to correct and prevent interruptions.

An Annual Report shall be submitted to the Regional Board by 1 February (1 November for semi-annual monitoring) of each year. This report shall contain an evaluation of the effectiveness and progress of the investigation and remediation, and may be substituted for the fourth quarter (or second semi-annual) monitoring report. The Annual Report shall contain the following minimum information:

- (a) both tabular and graphical summaries of all data obtained during the year;

MONITORING AND REPORTING PROGRAM ORDER NO. R5-200X-XXXX
DISCHARGER NAME
COUNTY

6

- (b) groundwater contour maps and pollutant concentration maps containing all data obtained during the previous year;
- (c) a discussion of the long-term trends in the concentrations of the pollutants in the groundwater monitoring wells;
- (d) an analysis of whether the pollutant plume is being effectively treated;
- (e) a description of all remedial activities conducted during the year, an analysis of their effectiveness in removing the pollutants, and plans to improve remediation system effectiveness;
- (f) an identification of any data gaps and potential deficiencies/redundancies in the monitoring system or reporting program; and
- (g) if desired, a proposal and rationale for any revisions to the groundwater sampling plan frequency and/or list of analytes.

A letter transmitting the monitoring reports shall accompany each report. Such a letter shall include a discussion of requirement violations found during the reporting period, and actions taken or planned for correcting noted violations, such as operation or facility modifications. If the Discharger has previously submitted a report describing corrective actions and/or a time schedule for implementing the corrective actions, reference to the previous correspondence will be satisfactory. The transmittal letter shall contain the penalty of perjury statement by the Discharger, or the Discharger's authorized agent, as described in the Standard Provisions General Reporting Requirements Section B.3.

The Discharger shall implement the above monitoring program on the first day of the month following adoption of this Order.

Ordered by:

PAMELA C. CREEDON Executive Officer

XX XXXXXXXX XXXX

(Date)

05/31/07:AMM

INFORMATION SHEET ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

1

Volatile organic compounds (VOCs), petroleum hydrocarbons, perchlorate and fumigants have impacted groundwater at numerous sites within the Central Valley Region and cause or threaten adverse impacts to existing and potential beneficial uses of groundwater resources. Those sites are being required to clean up the pollution and restore the beneficial uses of the groundwater. This cleanup can take many forms. The two most common methods of cleanup of groundwater pollution are pump and treat, and in-situ remediation. The operation and discharge of a pump and treat system is generally regulated under site-specific or general waste discharge requirements. Prior to this General Order, in-situ groundwater remediation projects have had site-specific waste discharge requirements issued. The process to develop and adopt site-specific waste discharge requirements can be lengthy. Many in-situ treatment processes have common components and issues that can be regulated under general waste discharge requirements.

In-situ remediation of groundwater pollution at most sites includes the use and application of biological, chemical, and/or physical treatment processes. These processes include addition of oxygen, chemical oxidation/reduction, and the addition of nutrients, carbon and/or bacteria to enhance biodegradation. The method of delivery can be via injection to soil or groundwater insitu, or via groundwater recirculation (extraction and treatment with return of treated groundwater to the impacted aquifer zone). In most instances the in-situ remediation processes will cause reducing or oxidizing conditions within the aquifer in order to either reduce or oxidize the target pollutant. The remediation processes can result in exceedances of water quality objectives that are generally limited in duration and/or in a relatively small portion of the aquifer. These waste discharge requirements allow exceedances of water quality objectives to occur while oxidation/reduction processes are taking place, but only within the treatment zone.

Oxidation/reduction reactions take place when an electron is transferred from one compound to another. The electron donor becomes oxidized, and the electron receptor becomes reduced. These are always coupled reactions. If a compound is reduced, another must necessarily be oxidized to provide the electron. Reducing environments are typified by the absence of oxygen and are also referred to as anaerobic environments. Oxidative environments contain oxygen and are also referred to as aerobic environments.

Reducing Environment Processes

The primary reduction processes that are effective on perchlorate and VOCs are anaerobic in nature as aerobic processes are generally not effective on most highly chlorinated VOCs. Aerobic dechlorination or aerobic cometabolism of perchloroethylene (PCE) and trichloroethylene (TCE) has not been successful at

INFORMATION SHEET ORDER NO. R5-2008-0149

2

IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES, SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

most sites. Therefore, reductive dechlorination of VOCs requires development of anaerobic conditions within the groundwater contaminant plume. PCE can be sequentially reduced to TCE, thence to cis-1,2-dichloroethylene, vinyl chloride and finally to ethane. Along the way the rate of reduction, consortium of bacteria involved in the process, and groundwater conditions may change. Reduction of VOCs may even stall at a stage if the correct conditions and bacteria are not present. Perchlorate reduction appears to occur more readily than VOCs and stalling at a particular stage in the dechlorination process does not occur

In order to develop a reducing environment to achieve reduction of chlorinated hydrocarbons and perchlorate, concentrations of oxygen and nitrate need to be significantly depleted. Oxygen and nitrate are more easily reduced than the chlorinated compounds and will utilize the electrons preferentially over the chlorinated compounds. Elevated concentrations of dissolved iron and manganese may also inhibit reduction of the chlorinated hydrocarbons by being electron acceptors.

There are three types of anaerobic reduction that may be occurring:

- **Direct Anaerobic Reductive Dechlorination** is a biological reaction in which bacteria gain energy and grow as one or more chlorine atoms on the chlorinated hydrocarbon molecule are replaced with hydrogen. In this reaction, the chlorinated compound serves as the electron acceptor, and the hydrogen serves directly as the electron donor (USEPA, 2000a).
- **Cometabolic Anaerobic Reductive Dechlorination** is a reaction in which a chlorinated compound is reduced by a non-specific enzyme or co-factor produced during microbial metabolism of another compound (i.e., the primary substrate) in an anaerobic environment. For the cometabolic process to be sustained, sufficient primary substrate is required to support growth of the transforming microorganisms.
- **Abiotic Reductive Dechlorination** is a chemical degradation reaction, not associated with biological activity in which a chlorinated hydrocarbon is reduced by a reactive compound. Addition of an organic substrate and creation of an anaerobic environment may create reactive compounds, such as metal sulfides, that can degrade chlorinated aromatic hydrocarbons (ITRC, 2007).

Of those three, direct anaerobic reductive dechlorination is the primary process for biological reduction of VOCs. In order to accomplish the complete reduction to ethane, the appropriate species of bacteria must be present. Lacking the complete consortium of bacteria could cause the process to stall at cis-1,2-DCE and vinyl chloride. If this condition occurs, adding bacteria that are known to

INFORMATION SHEET ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

3

effectively reduce cis-1,2-DCE and vinyl chloride is an option to correct the problem.

Hydrogen has a lead role as a direct electron donor in the anaerobic dechlorination of chlorinated aromatic hydrocarbons. Hydrogen is generated by fermentation of non-chlorinated organic substrates, including naturally occurring organic carbon, accidental releases of anthropogenic carbon (fuel), or introduced substrates such as carbohydrates (sugars), alcohols, and low-molecular-weight fatty acids (lactates, acetates, etc.). As hydrogen is produced by fermentative organisms, it is rapidly consumed by other bacteria, including denitrifiers, iron-reducers, sulfate-reducers, methanogens, and dechlorinating microorganisms. For anaerobic reductive dechlorination to occur, dechlorinators must successfully compete against other microorganisms that also utilize hydrogen (ITRC, 2007).

Generally, there are not sufficient numbers of bacteria naturally present to conduct an effective anaerobic dehalogenation process. To increase the concentration of bacteria biostimulation is implemented by injecting a carbon source or substrate into the groundwater. For the degradation of chlorinated ethenes, the injected carbon source provides for cell growth and ferments to produce products like hydrogen, providing an electron donor for the reductive dechlorination process. By adding electron donors, methanogenic and/or sulfate-reducing conditions can be achieved at a site, which can be used to dechlorinate cis-1,2-DCE and vinyl chloride. Complete reductive dechlorination to ethene without the accumulation of cis-1,2-DCE and vinyl chloride is most likely to occur under these strongly-reducing conditions (ITRC, 2007).

Biostimulation also may include injecting limiting nutrients, such as phosphorus or nitrogen. The advantage of biostimulation is that native populations present in the subsurface are already acclimated to the site, so enhancements such as the addition of nutrients will increase their biodegradation capacity. The disadvantage is that subsurface geology of a site may interfere with the introduction of nutrients, including the formation of preferential flow patterns due to fractures and impermeable lithology affecting the distribution of additives. Important subsurface characteristics to consider for biostimulation include velocity of the groundwater, and hydraulic conductivity of the soil. Pilot studies are usually conducted to provide additional site-specific information before full-scale implementation (ITRC, 2007).

Substrates added to promote reductive dechlorination come in many forms and may be soluble, low viscosity, high viscosity or solid. Soluble substrates, such as sugars, citric acid and lactic acid, may be applied in an aqueous phase offering uniform distribution throughout the aquifer. These dissolved substrates travel with advective groundwater flow and are typically applied continuously or

INFORMATION SHEET ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

4

periodically. The soluble substrates are consumed rather quickly and must be frequently replenished.

Substrates that are viscous are less mobile than soluble substrates, but they tend to last longer in the subsurface. Slow release materials such as vegetable oil or HRCTM, which are intended to be long lasting, may require a single or limited number of injections. The low mobility of viscous substrates may lead to non-uniform distribution and require different application mechanisms to achieve the desired distributions. These substrates are relatively immobile and rely on advective and dispersive qualities of soluble compounds (lactic acid for the HRC and metabolic acids for the oil) to deliver them throughout the subsurface (ITRC, 2007).

Moderate viscosity fluids such as emulsions of vegetable oil have a relatively high mobility as compared to solid or highly viscous materials that allows more uniform distribution within the aquifer. Emulsified oils slowly release hydrogen through fermentation of fatty acids. Other moderate viscosity substrates that could be used include, chitin, whey and oleate.

Oxidative Environment Processes

As with reductive processes, oxidation processes can be either chemically or biologically induced. A chemical oxidant removes electrons from constituents in the vicinity of the oxidant and the oxidant becomes reduced. In a biological oxidation process, one compound is the electron donor and another compound is the electron acceptor. An example of biological oxidation happens with fuel contaminants in groundwater. In an aerobic environment, fuel can provide the carbon and the electrons for microbial metabolism, and the oxidizing agent is oxygen, which is the electron acceptor. In the absence of oxygen, nitrate also serves as an electron acceptor. The fuel becomes degraded as it is oxidized.

Remediation of groundwater pollution, including VOCs, benzene, toluene, ethylbenzene, xylenes, organic pesticides, munitions (i.e., HMX, RDX), petroleum hydrocarbons or MTBE can potentially be achieved using chemical or biological oxidation processes. This involves injecting oxidants directly into the source and the downgradient plume, or delivering oxidants by means of a groundwater recirculation system. The oxidant reacts with the pollutants, producing innocuous substances such as carbon dioxide, water, and chloride. The four main chemical oxidants used are permanganate, peroxide, persulfate and ozone.

The ability of the oxidant to react with a certain contaminant in the field depends on kinetics, stoichiometry, thermodynamics and delivery of the oxidant. On a microscale, kinetics or reaction rates are the most important. The rates of

INFORMATION SHEET ORDER NO. R5-2008-0149

5

IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES, SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

oxidation reactions are dependent on many variables, such as, pH, temperature, concentration of the reactants, catalysts, reaction by-products, and impurities (oxidant scavengers, organic matter, etc.) that all must be taken into consideration.

The oxidant needs to be delivered in such a manner that the oxidant comes into the contact with the pollutant to be oxidized. The delivery goal is to ensure that the oxidant is dispersed evenly throughout the groundwater needing to be remediated. The solubility and rate of reaction of the oxidant need to be considered when developing the method of delivery of the oxidant.

Treatment Zone

The treatment zone is the area where the oxidation/reduction processes take place. During oxidation, several changes in water quality parameters can occur. The oxidation process can cause trivalent chromium present in formation materials and dissolved in the aquifer to be converted to hexavalent chromium, a much more toxic form of chromium. In addition, chlorides will be liberated if the pollutants being oxidized are chlorinated compounds. Increases in salts can occur if the oxidant being used has a salt component such as sodium or potassium.

Reduction processes have similar concerns with chlorides and salts. Reducing conditions will remove dissolved oxygen from the water, and can liberate excess concentrations of dissolved iron and manganese from formation materials, and generate methane, causing secondary water quality problems. These waste discharge requirements recognize that water quality objectives for some parameters may be exceeded within the treatment zone. However, water quality objectives are not allowed to be exceeded outside of the treatment zone. Monitor wells are established downgradient of the treatment zone for use as compliance wells. The monitor wells are used to measure compliance with water quality objectives and groundwater limitations.

The size of the treatment zone should be made as small as feasible, but in most cases will be driven by the plume configuration and design of the treatment system. The treatment zone could include a transition zone where ambient groundwater mixes with the treatment zone, reestablishing ambient oxidative conditions. In contact with the oxygen of ambient groundwater, the elevated concentrations of ferrous iron and dissolved manganese are oxidized, removing them from solution. Methane concentrations return to ambient concentrations much more slowly, and travel further than other reduced species. Therefore, the formation of methane should be avoided to the extent practicable by minimizing the degree of reducing conditions generated by the project. It is not appropriate

INFORMATION SHEET ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

6

to significantly increase the size of the treatment zone to simply allow for methane concentrations to reduce back to ambient levels.

Amendment Delivery

The in-situ treatment system is usually one of three types. One type utilizes a groundwater recirculation consisting of extraction and injection wells and provides control of the injectants and treatment zone. The extracted groundwater is amended aboveground and the amended water recharged upgradient of the extraction well. The second type injects the amendments into the groundwater and allows the groundwater to flow through the treatment zone. The third type uses extraction and injection wells to create a barrier with the treatment zone being established within and downgradient of the capture zone of the injection well(s). In this type of system the injection tends to occur downgradient of the extraction wells. The use of extraction and recharge systems is preferred as it provides greater flexibility and control of the treatment zone, and can be operated to help restore the treatment zone to pre-project conditions after remediation of the initial pollution has been completed.

Amendments

These waste discharge requirements require that the injectant materials be analyzed to determine the suitability of the materials to be used for in-situ remediation. Past analyses of various amendments, including corn syrup, molasses, HRC™ and edible oils have shown elevated concentrations of sodium and other salts, and trace metals in some of them. As the groundwater in the Central Valley is in many places adversely impacted by salts, the use of salt-containing amendments is discouraged. A project that proposes using a salt-containing amendment is required to demonstrate that there is no cost-effective, salt-free amendment that can be utilized to achieve adequate remediation of the pollution before allowing the salt-containing amendment to be used. In addition, amendments containing other pollutants such as metals could contribute to exceedances of water quality objectives and/or degradation of the groundwater.

Basin Plan, Beneficial Uses, Background Groundwater Quality and Water Quality Objectives

The *Water Quality Control Plan for the California Regional Water Quality Control Board Central Valley Region, Fourth Edition* (Basin Plan), designates beneficial uses, establishes water quality objectives, and contains implementation plans and policies for all waters of the Basin. Beneficial uses often determine the water quality objectives that apply to a water body. For example, waters designated as municipal and domestic supply must meet the maximum contaminant levels (MCLs) for drinking waters. The Basin Plan sets forth the applicable beneficial

INFORMATION SHEET ORDER NO. R5-2008-0149
 IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
 COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
 SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

7

uses (Industrial, agricultural, and domestic supply in this instance) of groundwater, procedure for application of water quality objectives, and the process for and factors to consider in allocating waste assimilation capacity.

The antidegradation directives of Section 13000 of the California Water Code require that waters of the State that are better in quality than established water quality objectives be maintained "consistent with the maximum benefit to the people of the State." Waters can be of high quality for some constituents or beneficial uses and not others. Policies and procedures for complying with this directive are set forth in the Basin Plan (including by reference State Water Board Resolution No. 68-16, "Statement of Policy With Respect to Maintaining High Quality Waters in California," or "Antidegradation" Policy).

Resolution 68-16 is applied on a case-by-case, constituent-by-constituent basis in determining whether a certain degree of degradation can be justified. It is incumbent upon the Discharger to provide technical information for the Board to evaluate that fully characterizes:

- All waste constituents to be discharged;
- The background quality of the uppermost layer of the uppermost aquifer;
- The background quality of other waters that may be affected;
- The underlying hydrogeologic conditions;
- Waste treatment and control measures;
- How treatment and control measures are justified as best practicable treatment and control;
- The extent the discharge will impact the quality of each aquifer; and
- The expected degradation to water quality objectives.

In allowing a discharge, the Board must comply with CWC section 13263 in setting appropriate conditions. The Board is required, relative to the groundwater that may be affected by the discharge, to implement the Basin Plan and consider the beneficial uses to be protected along with the water quality objectives essential for that purpose. The Board need not authorize the full utilization of the waste assimilation capacity of the groundwater (CWC 13263(b)) and must consider other waste discharges and factors that affect that capacity.

The project proponent is required to determine background groundwater quality. The background data is used to determine compliance with water quality limitations at the points of compliance downgradient from the treatment zone. As stated above, salts can increase due to the dehalogenation of volatile organics or other pollutants or from salts present in amendments. Metals can be solubilized

INFORMATION SHEET ORDER NO. R5-2008-0149
IN-SITU GROUNDWATER REMEDIATION AT SITES WITH VOLATILE ORGANIC
COMPOUNDS, NITROGEN COMPOUNDS, PERCHLORATE, PESTICIDES,
SEMI-VOLATILE COMPOUNDS AND/OR PETROLEUM HYDROCARBONS

8

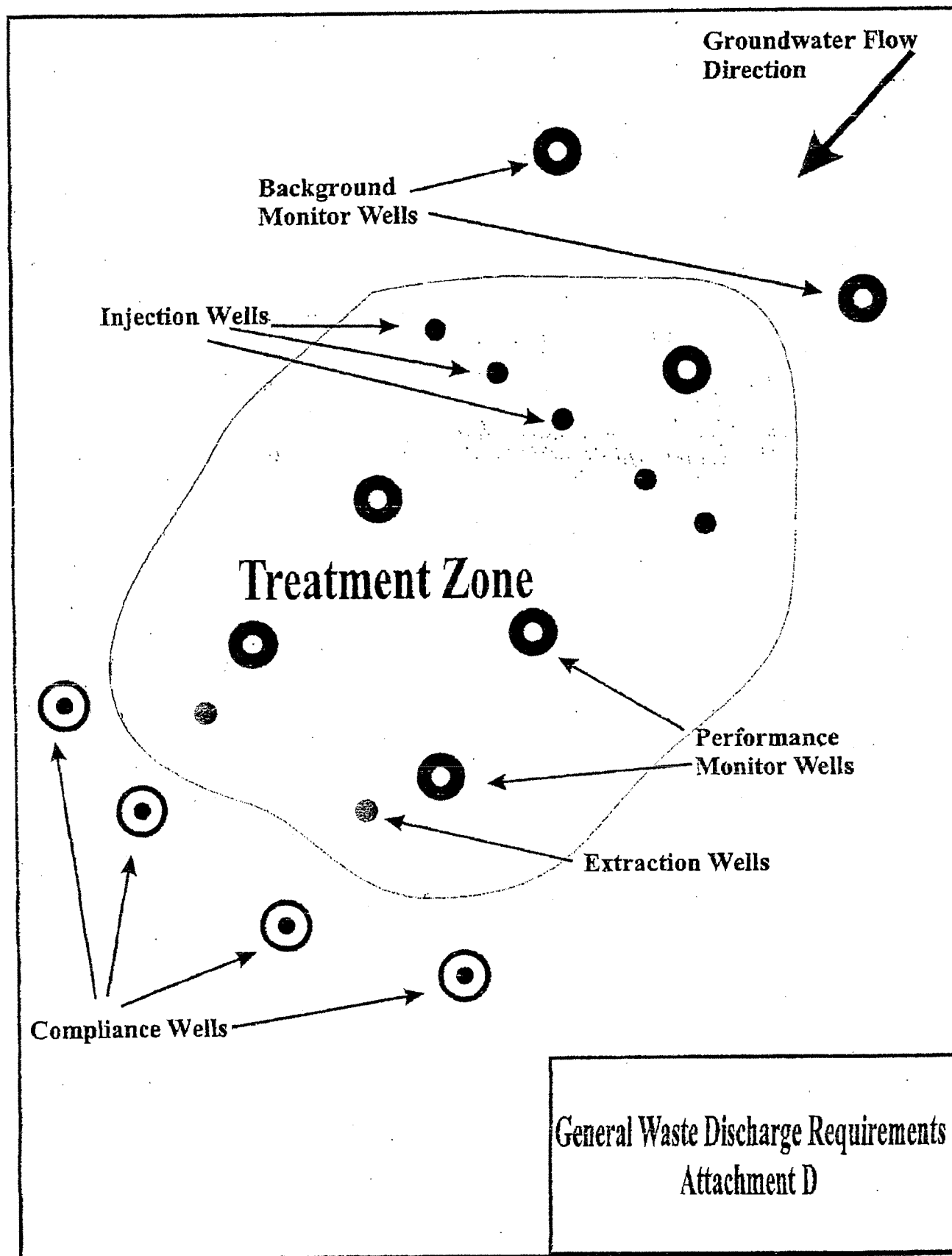
from aquifer materials by the reduction process, be released from amendments during reactions, or change to more toxic states during the oxidation process. These waste discharge requirements allow a slight increase (20% over background) in metals and salts, as long as water quality objectives are met. A value of less than 20% would be within the error of duplicate analysis comparability criteria and an exceedance not always verifiable. Water quality objectives for the anticipated pollutants that are found at these remediation projects are established in the Findings. The water quality objectives are established based on the numerical and narrative standards found in the Basin Plan.

Coverage Under the Order

To obtain coverage under the order, the project proponent must submit a Notice of Intent (NOI) and supplemental information listed in Attachment A. The information requirements are significant as these projects are complex and require a great deal of knowledge about the project site and remediation processes. Though the requirement for submittal of information is substantial, it should be information that has already been developed by the project in order to justify the remediation project to the appropriate regulatory agency.

In order for coverage to occur, the project proponent needs to demonstrate through laboratory-scale tests that the proposed project will adequately promote remediation of the pollution. The laboratory-scale tests will also be used to identify potential adverse water quality impacts with the project and help establish monitoring parameters. If there are data from projects sufficiently similar to the proposed project, the proponent can use that information in lieu performing the laboratory-scale testing, as appropriate. Once the project is completed, the project proponent will file for termination of coverage under the general order.

AMMASTWMLP



I, the undersigned, declare that I am, and was at the time of service of the paper(s) herein referred to, over the age of 18 years and not a party to this action. My business address is 1050 Fulton Avenue, Suite 100, Sacramento, CA 95825-4225.

EXPERT REPORT OF RICHARD L. HABERMAN, PE

Executed on December 5, 2011, at Sacramento, California.



 MATTHEW POPISH

EXHIBIT 3

BRIAN M. LEDGER
BLEDGER@GORDONREES.COM
DIRECT DIAL: (619) 230-7729



GORDON & REES LLP
Mar 21 2012 6:29PM

ATTORNEYS AT LAW
101 W. BROADWAY, SUITE 2000
SAN DIEGO, CA 92101
PHONE: (619) 696-6700
FAX: (619) 696-7124
WWW.GORDONREES.COM

March 21, 2012

Via LexisNexis

Tracey L. O'Reilly
Miller, Axline & Sawyer
1050 Fulton Avenue, Suite 100
Sacramento, CA 95825-4225

Re: City of Fresno vs. Chevron U.S.A., et al

Dear Ms. O'Reilly:

I am writing in regards to Plaintiff's Motion to Preclude Duplicative Expert Depositions and Discovery ("Plaintiff's Motion") and regarding your letter to Whitney Jones Roy dated March 20, 2012 concerning the document production of the City's expert Marcel Moreau.

As to Plaintiff's Motion, Plaintiff argues that there is no compelling need for depositions of Plaintiff's non-station-specific expert witnesses because they have each been deposed multiple times in prior MTBE cases. Kern Oil & Refining Co. ("Kern") was not involved in any of the referenced prior MTBE cases. Although Plaintiff may be correct in arguing that the depositions in these prior cases for these expert witnesses addressed all necessary issues, Kern has no way of verifying the accuracy of this argument without having the opportunity to review the pertinent deposition transcripts. Accordingly, I request that Plaintiff provide me with copies of the pertinent deposition transcripts for Plaintiff's non-station-specific expert witnesses as soon as possible at Plaintiff's expense.

As to Plaintiff's expert Marcel Moreau, you indicate in your letter of March 20, 2012 that copies of the references for Mr. Moreau's reports have "already been produced in previous cases such as City of Merced, City of Merced Redevelopment Agency and Orange County Water District." Kern was not involved in any of these cases and, accordingly, does not have access to these references. Accordingly, I request that you provide me with copies of these references as soon as possible at Plaintiff's expense.

EXHIBIT 3

Tracey L. O'Reilly
March 21, 2012
Page 2

Thank you for your anticipated courtesy and cooperation.

Sincerely,

GORDON & REES LLP

A handwritten signature in black ink, appearing to read "Brian M. Ledger", written over the printed name.

Brian M. Ledger

BML:mg

EXHIBIT 4



March 21, 2012

VIA File & Serve

Tracey L. O'Reilly
Miller, Axline & Sawyer
1050 Fulton Avenue, Suite 100
Sacramento, CA 95825-4225

Re: In Re Methyl Tertiary Butyl Ether Products Liability Litigation: *City of Fresno v. Chevron U.S.A., et al.*, Case No. 04 Civ. 04973 (SAS) MDL 1358, United States District Court for the Southern District of New York

Dear Ms. O'Reilly:

I write regarding Plaintiff's Motion to Preclude Duplicative Expert Depositions and Discovery. In its motion, plaintiff states the non-station specific experts have been deposed numerous times in other MTBE cases and to depose them again would be "inefficient [and] duplicative." Plaintiff proposes that the parties rely upon "depositions taken in the *Crescent, City Of Merced, City of Merced Redevelopment Agency and Orange County Water District* matters as those matters involve the same counsel for plaintiffs and defendants."

As an initial matter, Nella was not a party to the *Crescent, City Of Merced, City of Merced Redevelopment Agency and Orange County Water District* cases. Therefore, those matters do not involve the same counsel for plaintiffs and defendants. Further, because Nella was not a party to those matters, it does not have access to those deposition transcripts. As such, Nella cannot assess plaintiff's argument that those expert depositions addressed all issues relevant to the City of Fresno litigation without reviewing the pertinent deposition transcripts. Accordingly, I request that plaintiff provide us, at plaintiff's expense, with copies of all pertinent deposition transcripts for plaintiff's non-station specific expert witnesses as soon as possible.

Very truly yours,

Rachel Wintterle

E-mail: rachel.wintterle@leclairryan.com
Direct Phone: 415.913.4915
Direct Fax: 415.381.8766

44 Montgomery Street, Eighteenth Floor
San Francisco, California 94104
Phone: 415.391.7111 \ Fax: 415.391.8766

CALIFORNIA \ CONNECTICUT \ MASSACHUSETTS \ MICHIGAN \ NEW JERSEY \ NEW YORK \ PENNSYLVANIA \ VIRGINIA \ WASHINGTON, D.C.

LeClairRyan is a Delaware Limited Liability Partnership
ATTORNEYS AT LAW \ WWW.LECLAIRRYAN.COM

EXHIBIT 4